"बिजनेस पोस्ट के अन्तर्गत डाक शुल्क के नगद भुगतान (बिना डाक टिकट) के प्रेषण हेतु अनुमत. क्रमांक जी. 2-22-छत्तीसगढ़ गजट/38 सि. से. भिलाई, दिनांक 30-5-2001."

पंजीयन क्रमांक "छत्तीसगढ़/दुर्ग/तक. 114-009/2003/20-1-03."

छत्तीसगढ़ राजपत्र

(असाधारण)
प्राधिकार से प्रकाशित

क्रमांक 319] रायपुर, शनिवार, दिनांक 30 दिसम्बर 2006—पौष 9, शक 1928

CHHATTISGARH STATE ELECTRICITY REGULATORY COMMISSION
Civil Lines, G.E. Road, Raipur (C.G.)

Raipur, the 23rd December 2006

No. 14/CSERC/2006. In exercise of powers conferred by section 86(1)(h) read with Section 181(ZP) of the Electricity Act, 2003 (No. 36 of 2003), the Chhattisgarh State Electricity Regulatory Commission hereby makes the following Regulation to be known as "**Chhattisgarh State Electricity Grid Code-2007**".

CHAPTER : 1
GENERAL & DEFINITIONS

1.1 Introduction

The Electricity Act 2003 in Section 86(1)(h) requires that the State Commission should specify a State Grid Code that is consistent with the Indian Electricity Grid Code **(IEGC).** This Grid Code has been formulated in pursuance of this provision. This Grid Code shall be a legally enforceable, interface document agreed upon and to be complied with by all entities connected to the State transmission system and open access customers interconnected to the system. The Grid Code has been designed to ensure an efficient and coordinated State transmission system and allow State transmission utility (STU) to comply with its obligations in relation to the inter-state transmission of power.

1.2 Short title, extent and commencement

1. These Regulations shall be called the Chhattisgarh State Electricity Grid Code, 2007.
2. These Regulations shall extend to the whole of Chhattisgarh.
3. These Regulations shall come into force from the date of their publication in the Chhattisgarh Rajpatra.

1.3 Definitions

1.3.1 In these Regulations unless the context otherwise requires :

(a) **"Act"** means the Electricity Act 2003 (36 of Act 2003), including amendments thereto;

(b) **"Active Energy"** means the electrical energy produced, flowing or supplied by an electrical circuit during a time interval, and being the integral of the instantaneous power with respect to time, measured in units of watt hours or standard multiples thereof :

1,000 Wh = 1 kWh = 1 Unit, 1,000 kWh = 1 MWh, 1,000 MWh = 1 GWh = 1 MU (Million Units)

(c) **"Active Power"** means the product of voltage and the in-phase component of alter nating current measured in units of watts and standard multiples thereof :

1,000 W = 1 kW, 1,000 kW = 1 MW, 1,000 MW = 1 GW

(d) **"Apparent Energy"** means the integral of the apparent power with respect to time. It is measured in Volt Ampere hour and standard multiple thereof, which is:

1,000 VAh = 1 kVAh, 1,000 kVAh = 1 MVAh, 1,000 MVAh = 1 GVAh

(e) **"Apparent Power"** means the product of voltage and current measured in units of volt amperes and standard multiples thereof, which is:

1,000 VA = 1 kVA, 1,000 kVA = 1 MVA, 1,000 MVA = 1 GVA

(f) **"Reactive Energy"** means the integral of the Reactive Power with respect to time. It is measured in volt amperes reactive hours and standard multiple thereof, that is:

1,000 VArh = 1 kVArh, 1,000 kVArh = 1 MVArh, 1,000 MVArh = 1 GVArh

(g) **"Reactive Power"** means the product of voltage and current and the sine of the phase angle between them measured in units of volt amperes reactive and standard multiples thereof, that is:

1,000 VAr = 1 kVAr, 1,000 kVAr = 1 MVAr, 1,000 MVAr = 1 GVAr

(h) **"Apparatus"** means the electrical apparatus and includes all machines, fittings, accessories and appliances in which conductors are used.

(i) **"Automatic Voltage Regulator** "(AVR) " means a continuously acting automatic excitation system to control the voltage of a generating unit as measured at the generator terminals;

(j) **"Backing Down"** means the instructions of SLDC or WRLDC conveyed through SLDC, for reduction of generation of a generating unit under abnormal conditions such as high frequency, low system demand or network constraints;

(k) **"Black Start Procedure"** means the procedure necessary to recover the grid from a partial or total blackout;

(l) "**Breakdown**" " means an occurrence relating to equipment of supply system which prevents its normal functioning;

(m) **"Central Electricity Regulatory Commission" or "Central Commission"** means the Commission set up under Section 76 of the Act;

(n) **"Central Transmission Utility" or "CTU"** means any Government company which the Central Government may notify as such under sub-section (1) of section 38;

(o) **"Commission" or "CSERC"** " means the Chhattisgarh State Electricity Regulatory Commission;

(p) **"Connection point"** means a point at which a user's and/or generating plants apparatus connecting to the intra-State transmission system;

(q) **"CSEB" or "Board"** means the Chhattisgarh State Electricity Board;

(r) "**Demand**" means the demand of active power MW, reactive power MVAR and apparent power MVA of electricity unless otherwise stated;

(s) **"Data Acquisition System"** means a device provided to record the sequence of operation in time, relays/equipments/system parameters at a locations;

(t) **"df/dt Relay** " means a relay which operates when the rate of change of system frequency (over time) goes higher than a specified limit and initiates load shedding ;

(u) **"Dispatch Instructions""** means an instruction by SLDC or SSGS (other than CGP) to dispatch generation and to Discom to regulate drawal in accordance with the Scheduling & Dispatch procedure of Grid Code;

(v) **"Distribution Company (Discom)** " means a company engaged primarily in the business of distribution and supply of electricity in its area of supply and licensed to do so under Section 12 of the Act;

(w) **"Disturbance Recorder** " means a device provided to record the behavior of the pre-selected digital and analog values of the system parameters during an events;

(x) "**Drawal**" means the transfer of electricity from the transmission system.

(y) **"Event"** means a unscheduled or unplanned occurrence in the intra State Transmission system including faults, incidents and breakdowns;

(z) **"Event logger"** means a device provided to record the sequence of operation in time, relays/equipments at a location during an events;

(aa) **"Extra High Tension" or "EHT"** means voltage higher than 33kV;

(bb) **"Fault Locator"** means a device provided at the end of a transmission line to measure/indicate the distance at which a line fault may have occurred.

(cc) **"Flexible Alternating Current Transmission (FACT)"** means facilities that enable power flow of A.C lines to be regulated, to control loop flows, line loading etc.;

(dd) **"Generating Plant"** means a generating station which shall include a captive generating plant (CGP);

(ee) **" High Tension" or "HT"** means voltage higher than 650V but which does not exceeds 33 kv under normal conditions subject to the percentage variation allowed under the Indian Electricity Rules,1956.

(ff) **"Indian Electricity Grid Code" or "IEGC"** means the central grid code specified by the Central Commission in accordance with sub section 1(h) of Section 79 of the Act..

(gg) **"Intra State Transmission System" or "State Transmission System" or "STS"** means any system for conveyance of electricity by transmission lines within the area of the state and includes all transmission lines, sub-stations and associated equipment of transmission licensee in the state;

Provided that the point of separation between a transmission system and distribution system shall be the outgoing point of feeder emanating from sub-station feeding to the distribution system;

(hh) **"Maximum Continuous Rating"** (MCR) means the normal rated full load MW output capacity of a generating unit, which can be sustained on a continuous basis at specified conditions;

(ii) **"Operation"** means a schedule or plant action related to the operation of a system;

(jj) **"Open Access Regulation"** means the Chhattisgarh State Electricity Regulatory Commission (Intra State Open Access in Chhattisgarh) Regulation 2005;

(kk) **"Peak Period"** means the period in a day when demand for electricity is at its highest or as directed by the Commission.

(ll) **"Planned Outage"** in relation to a SSGS unit means outage of power station equipment and in relation to transmission facility means outage of transmission lines and equipments, which have been planed and agreed with SLDC in advance, during a year;

(mm) **"Simultaneous Maximum Demand" SMD** means the maximum demand value out of all such simultaneous demands for a month: -

a. For a given demand period, sum of individual demand across all interface points in a distribution system gives simultaneous demand of a distribution licensee for a given period.

b. Maximum demand means the 4 times maximum value of average KVA delivered to consumers at the point of supply during any consecutive period of 15 minutes during the month computed on sliding window principle of measurement.

(nn) **"Single Line Diagram"** means diagrams which are a schematic representation of the HV/EHV apparatus and the connections to all external circuits at a connection point incorporating its numbering nomenclature and labeling;

(oo) **"Site Common Drawing"** means drawings prepared for each connection point, which incorporates layout drawings, electrical layout drawings, common protection/control drawings and common service drawings;

(pp) **"Spinning Reserve"** means the reserve capacity of a generating station which is only partially loaded, that is synchronized to the system and is ready to provide increased generation at short notice pursuant to dispatch instruction, or instanta neously in response to a frequency drop;

(qq) **"State Grid"** means the synchronously connected entire electric network of the Chhattisgarh State comprising of STS ,SSGS, generating plants and user.

(rr) **"State Load Despatch Centre" or "SLDC"** means the centre established under sub-section (1) of section 39.

(ss) **"State Sub-Load Despatch Centre" or "SSLDC"** means the offices and associated facilities of the State Load Despatch centre set up at places other than the location of the SLDC for monitoring and control of the State grid;

(tt) **"State Sector Generating Station" or "SSGS"** means any generating station which is connected with the State grid;

(uu) **"Static VAR Compensator"** means an electrical facility designed for the purpose of generating or absorbing Reactive Power;

(vv) **"Supervisory Control and Data Acquisition" or "SCADA"** means the combination of transducers, remote terminal unit communication links and data processing systems which provides information to the SLDC on the operational state of the State transmission system;

(ww) **"Synchronize"** means the condition where an incoming generating unit or system is connected to another system so that the voltage, frequencies and phase relationships of that generating unit or system, as the case may be, and the system to which it is connected are identical and the terms "synchronize" and "synchronization" shall be construed accordingly.

(xx) **"Time block"** block of 15.00 or 30.00 minutes during which energy meter records specified electrical parameters. For recording of MD in MW or MVA the measurement during the time block may be either on block interval or on sliding window principle.

(yy) **"Under Frequency Relay"** means a relay which operates when the system frequency falls below a specified limit and initiates load shedding

(zz) **"User"** means a person, including a generating plants, transmission licensees, distribution licensees of Chhattisgarh and/or open access customers who use the State transmission system.

1.3.2 Words or expressions used herein and not defined shall have the meanings assigned to them under the Act and other Regulations issued by the commission.

1.4 General

1.4.1 These Regulations shall apply to the SLDC, all transmission licensees in the State and every user who is connected to and/or uses the intra-State transmission system. Any matters not specified in this Code shall be as per the Indian Electricity Grid Code and it shall be binding to all users who are connected with the grid.

1.4.2 A transmission licensee or user having connections to the intra-State transmission system as on date of notification of this Code shall be given a maximum period of three months to comply with the following requirements under this Code:

(i) Entering into a connection agreement in accordance with clause 4.20 of this Code

(ii) Developing site responsibility schedules in accordance with clause 4.7

1.4.3 The date of applicability of provisions related to free governor action, as provided in this Code, shall be in consistent with the relevant provisions in the/EGC.

CHAPTER : 2

GRID CODE REVIEW COMMITTEE

2.1 General

2.1.1 The STU shall be responsible for managing and servicing this Code.

2.1.2 Constitution of the Grid Code Review Committee:
The Committee shall consist of the following members:

1. Member (T & D) of CSEB or MD of STU - Chairman
2. Chief Engineer, Transmission, of CSEB/ or of Successor Transmission Company- Member Secretary
3. Chief Engineer or In-charge of generation of CSEB/ or of Successor Generating Company - Member
4. Chief Engineer or In-charge of SLDC- Member
5. One representative of each of distribution licensees - Member
6. One representative of generating plants other than the Generating Plants of CSEB or its successor with installed capacity of 500 MW and above - Member
7. One representative of the association, if any, of other generating plants other than at 6 above - Member.
8. Representative of WREB/WRLDC- special invitee.

2.1.3 The STU shall arrange for public notification of the names and address of the Committee Chairman and Member Secretary of the Committee within 30 days of the approval of the Grid Code.

2.2 Functions of the committee.

2.2.1 The functions of the Grid Code Review Committee shall be as follows: -

(i) To keep the Grid Code and its working under scrutiny and review.

(ii) To suggest any revision, if necessary, in the Grid Code consequent to analysis report on major grid disturbance soon after its occurrence.

(iii) To consider all suggestions/proposals for load-shedding through under frequency relays or otherwise and same shall be submitted for approval of Commission.

(iv) To consider all suggestions/proposals for revision of the Grid Code.

(v) To examine problems raised by users and STU.

2.2.2 The Committee will meet once in six months. The quorum for meeting of the committee shall be of four members.

2.2.3 The Member Secretary shall present all proposals for revisions of the Grid Code to the Committee for its consideration.

2.2.4 The Committee may set up sub-committees for detailed study of related problems. The sub-committees may discuss with a user its individual requirements and with groups of users to prepare proposals for the Grid review committee .

2.2.5 The recommendations of the Committee may be submitted to the Commission for approval. The Commission may amend the Grid Code suo-motu or on the recommendations of the committee as may be deemed fit, to prevent recurrence. However, before any amendment is made in this code, comments on the proposed changes shall be obtained from all the users and the public.

2.2.6 The STU shall make available a copy of the Grid Code and its amendments in force for sale.

CHAPTER : 3

PLANNING CODE

3.1 Transmission system planning

3.1.1 In accordance with section 39 (2) (b) of the Electricity Act 2003, the State Transmission Utility (STU) shall discharge all functions of planning and coordination relating to the state transmission system (STS) with CTU, State Govt., Central Electricity Authority and other related organizations which may utilize the state transmission system for evacuation or drawal of power from state transmission system.

3.1.2 The system planning specifies the technical and design criteria and procedure to be adopted by STU for the planning and development of the transmission system. The users of the transmission system shall take such system planning into account for planning and development of their own system. The STU in consultation with the users, shall evolve an efficient, secured and economical intra-state transmission system in order to satisfy the requirements of demand and generation.

3.1.3 The formats of the transmission system plans shall be provided to user(s) by the State transmission utility.

3.1.4 The need for reinforcement and extension of the system arises due to many reasons of which a few are mentioned below:-

(i) The development on a user's system already connected to the transmission system.

(ii) Introduction of a new connection point between an user's system and the transmission system.

(iii) The need to increase system capacity, removal of operational constraints, maintenance of security standards and meeting general increase in demand.

(iv) Steady state and transient stability considerations.

(v) Cumulative effect of any combination of the above four.

3.1.5 The work of such reinforcement and extension of the transmission system may also involve work at a connection point / interface point of a generating plants / distribution licensee with the transmission system.

3.1.6 The development of the transmission system must be planned in advance duly allowing sufficient lead time, considering the following:

(a) The time required for detailed engineering, design and construction work to be carried out. The system planning therefore, enforces the time scales for exchange of information between the STU and the user(s). All the concerned parties, wherever appropriate, shall have due regard to the confidentiality of such information;

(b) The time required for obtaining the necessary statutory approvals such as notification in government gazette and leading newspapers, Power and Telecommunication Co-ordination Committee (PTCC) clearance, Forest clearance, Railway clearance, clearance from civil aviation authorities, National highways, State highways etc., and the right of way permissions wherever required.

3.2 Perspective Plan:

3.2.1 Load forecasting shall be the primary responsibility of distribution licensees within their area of supply. The distribution licensees shall determine the peak load and energy forecast of their areas for each of the succeeding 10 years and submit the same annually by 30th November to the STU. These shall include the details of demand forecasts, data methodology and assumptions on which the forecasts are based. The peak load and energy forecast shall be made for the overall area of supply.

3.2.2 The STU shall also review the methodology and assumptions used by the distribution licensees in making the load forecast, in consultation with them. The resulting overall forecast will from the basis of planning for expansion of transmission system, which will be carried out by the STU. To maintain the reliability of the interconnected regional power systems, all participants must comply with the planning criteria/guidelines of CEA, as updated from time to time.

3.2.3 The STU shall forecast annual peak load for each connection point / interface point with the transmission system. The peak load requirement at each connection point / interface point will be ensured by the STU. It may determine the corrective measures to be taken to maintain the capacity adequacy in the transmission system up to the connection point/interface point. This will facilitate the transmission licensee to develop a compatible transmission system. However, if the distribution licensee receives power at a number of connection points/interface points in a compact area, which are interconnected in a ring then the load forecast should take care of that of transmission system the maximum load at any point of time is to be taken. These forecasts shall be updated annually and also whenever major changes are made in the existing system.

3.2.4 The STU shall be responsible for integrating the load forecast submitted by each of the distribution licensees and determining the long-term (10 years) load forecast for the State. For determining the requirements for the entire State, an appropriate diversity factor from the data available for the previous years shall have to be chosen.

3.2.5 The STU shall forecast the demand for power within its transmission area for each of the succeeding ten years and provide to the CSERC the details of demand forecasts, data, methodology and assumptions on which the forecasts are based. The STU shall be responsible to prepare and submit a long-term (10 years) plan to the Commission for the compatible expansion of the intra-state transmission system to meet the future demands. Such planning shall be in conformity with the national perspective for power generation and transmission plan prepared by the CEA. This compatible intra-state transmission plan shall also include provision for reactive compensation needed for the transmission system.

3.3 Planning Standards and Procedures:

3.3.1 The State Transmission System shall be planned in accordance with the "Trans mission System Planning and Security Standard" as given below.

(A) Introduction

The Transmission System Planning and Security Standard are the guidelines for planning and expansion of Transmission System in the State. The scope of this standard covers:

(a) system studies;
(b) assessment of the system data;
(c) assessment of generation availability;
(d) planning criteria;
(e) security conditions required for maintaining specified degree of reliability;
(f) criteria for sub station planning; and
(g) estimation of reactive power compensation required.

(B) Transmission Planning

1. The long term perspective planning involves an integrated approach for evacuating power from different generating stations, irrespective of their ownership, and delivering it to the beneficiaries over an optimally designed transmission system with reliability, security and economy. The power system in the State grid has to be planned in such a manner, that the power received from all generating plants, and traders the share of power from Western grid and central sector generating stations, can be transmitted without constraints to different beneficiaries, as per their allocated shares, maintaining a reasonably good voltage profile, stability conditions and redundancy criteria.

2. The transmission planning should be developed to achieve a strong coordinated power system for the Western region and ultimately a national grid, where substantial inter-regional transfers can be achieved with optimized utilization of available generation. The transmission planning shall also provide a high standard of supply to beneficiaries with acceptable degree of reliability and at reasonable cost. The criterion should be that even under the conditions of the specified outages considered in the security standards, the power flow should not be affected. The transmission planning should keep in view the long term future load growth also and the transmission lines and sub-stations shall be so planned that the same can be upgraded when necessary in future, with minimum interruptions and modifications.

3. For the purpose of reducing inventory, procurement time and installation time, the transmission licensee shall adopt standardized designs as far as possible for transmission line towers, structures for sub-stations, sub-station lighting, control room lighting and ventilation, sub-station earthing, standardized specification for line materials, transformers, substation equipment, cables, bus bar accessories, insulators, hardwares, lightening arrestors etc.

4. The possibility of providing adequate connections within the State grid as well as with inter state grids has to be considered wherever economically feasible considering all economic energy/capacity interchanges. The modern Flexible AC transmission system (FACTS) based on thyristor based controls, HVDC, fast controllable phase shifters etc., have also to be considered wherever economically feasible and/or constraints of corridor for construction of new transmission lines.

(C) System studies:

1. The loads to be supplied from various sub-stations at steady state within the limits of declared voltage and acceptable frequency of 50 Hz and the future load development has to be assessed after making a detailed study of the present conditions and a load survey. A reasonable estimate of transmission losses shall also be included for arriving at peak availability, The system is to be further evolved based on the following power system studies:
   - (a) Load flow
   - (b) Optimal power flow for various conditions
   - (c) Short circuit
   - (d) System stability – steady state
   - (e) System stability – transient
   - (f) Studies to determine switching / temporary over voltages
   - (g) Other studies as required.

2. These studies require suitable computer programs. The models incorporating generation, transmission and load shall be prepared separately for each year of a plan period assessing probable year of commissioning of particular lines, substations, additional transformers in existing sub-stations etc., based on the

system network for the year in question with all the generation and load buses properly located. Inter connections with the western grid through neighboring states at 400kV and 220kV levels shall have to be incorporated. Appropriate equivalent circuit models shall be used to take into account the fault level at the connection points / interface points,. The interconnection buses shall be models by representing significant and necessary portions of the neighboring networks to represent realistically the MW and MVA imports/exports. Studies shall be carried out both for peak load and zero load conditions.

(D) System data

To arrive at a reasonably accurate load forecast and for conducting studies, compilation and updating of system data is absolutely necessary. The planning study should begin with the proper representation of the existing system to establish the base case and to validate the model. The results obtained for the existing system should be verified with the meter readings, logged data at the sub-stations and the State Load Dispatch Centre to closely match the same. The system parameters have to be updated incorporating the correct data whenever addition or modifications have been carried out on the system either by the survey of the correct line lengths and conductor configurations or preferably by direct measurement of the line impedance values whenever and wherever possible. All the system data shall be the same for both the planning standards and operation standards. The loads shall be modeled at 220KV and 132KV buses. The annual minimum load shall be taken as a percentage of annual peak demand as prevailing in the base year.

(E) Generation:

For peak load conditions, different generation mixes of various generating stations, resulting in an optimal average cost shall be determined by conducting the required number of load flow studies, or using well developed computer software packages to determine the same. For the minimum load conditions, the generator which "must run", shall be used in conjunction with the most economical generation. The generation dispatch for the purpose of sensitivity analysis corresponding to a complete shutdown of a major generating station shall be worked out by increasing the generation at other stations to the extent possible keeping in view the maximum likely availability at those stations, cost of power, etc. transmission constraints will have to be addressed properly. The transmission system being planned shall consider the adequacy of the network required to transmit power even under various outage conditions specified in the security standards. Studies shall be repeated for normal and contingency conditions as required in the security standards.

(F) Planning criteria:

1. The Central Electricity Authority (CEA's) "Manual on Transmission Planning Criteria" shall be adopted with modification as stated below, particularly with reference to steady state voltage limits and security standards for withstanding outages.

2. The transmission shall be planned in such a way so as to maintain steady state voltage within limits as stated below:

Nominal system Voltage kV-rms.	Maximum kV-rms.	Minimum kV-rms.
132	145	120
220	245	200
400	420	380

(G) Line loading limits:

The permissible line loading limits shall conform to CEA's "Manual on Transmission Planning Criteria". The over loading and under loading of lines shall be decided accordingly.

(H) Options for strengthening of transmission network:

(a) Addition of new transmission lines to avoid over loading of existing system (wherever three or more circuits of the same voltage class are envisaged between two sub-stations, the next higher transmission voltage may be considered).

(b) Up-gradation of the existing transmission lines such as raising height of conductor supports and / or switch over to insulated cross-arms to facilitate change over to higher voltage, if the tower design so permits.

(c) Replacement of conductor of the existing transmission line with higher size of conductors or with AAAC (All Aluminium Alloy Conductor).

(d) The choice shall be based on cost, reliability, right of way requirements energy losses, down time, etc.

(e) All single circuit lines shall be planned generally with double circuit towers, wherever technically feasible, to enable future expansion without right of way problems.

(I) Security standards:

1. Steady State Stability:

The system shall be planned to withstand satisfactorily without any load shedding or altering the generation at generating stations for at least, any one of the following outage conditions:

a) Outage of any tower in a D/C transmission line.
b) Two circuits of 132kV or 220kV lines.
c) One circuit of 400KV line
d) One interconnecting transformer
e) One largest capacity generator
f) One inter-connecting line with neighboring grid.

The above contingencies shall be considered assuming a pre-contingency system depletion (planned outage) of another 220kV double circuit line or 400kV single circuit line in another corridor and not emanating from the same sub-station. All the generating stations shall operate within the limits as per their reactive capability curves and the network voltage profile shall also be maintained within the specified voltage limits.

2. Transient stability:

The system shall be designed to maintain synchronism and system integrity under the following disturbances:

(a) Outage of the largest size generator in the Western grid or connection with neighboring grids.

(b) A single line to ground fault on a 400 kv line, single pole opening of the faulty phase (5 cycles) with unsuccessful reclosure (dead time 1 sec) followed by 3 pole opening (5 cycles) of the faulty line.

(c) 400 kV D/C line.

i. When both the circuits are in operation, the system shall be capable of withstanding a permanent fault on one of the circuits followed by a three-pole opening (100-m.sec.) of the faulted circuit.

ii. When one of the circuits is under maintenance / outage the system shall be capable of withstanding a transient fault on the circuit in service.

(d) A permanent 3-phase fault with duration of 8-cycles on 220 kV or 132kV line assuming three-pole opening.

(e) No stability studies for faults are required for radial lines.

(J) Substation planning criteria:

1. For meeting a particular quantum of load, the number of required Sub-stations depends upon the choice of voltage levels, the MVA capacity and the number of feeders permissible etc. The number of EHT transformers, Interconnecting Transformers shall also be considered in planning to take care of contingencies of planned/forced outages. The rupturing capacity of the circuit breakers shall have 20 percent margin to take care of increase in short circuit levels as the system grows. The following criteria can be adopted:

(a) The capacity of any single substation at different voltage levels shall not normally exceed:

400kV	1000 MVA
220 kV	500 MVA
132 kV	150 MVA

(b) Size and number of Interconnecting Transformers (ICTs) shall be planned in such a way that the outage of any single unit would not overload the remaining ICTs or the underlying system.

(c) Size and number of installed Transformers shall be planned in such a manner that in the event of outage of any single unit, the remaining transformers may supply adequate load. This has to be achieved in such a manner that, with the connection of the adjacent Sub-stations, the load exceeding the capacity of the available transformers may be transferred on to them.

(d) The rated rupturing capacity of the circuit breakers in any Sub-station shall not be less than 120% of the maximum fault levels at the sub-stations. (The 20% margin is intended to take care of increase in short circuit levels as the system grows). The minimum rated rupturing capacity and duration of switchgear at different voltage levels are as follows:

132 kV	31.5 kA for 1 or 3 sec*
220 kV	40 kA for 1 sec
400kV	40 kA for 1 sec

* 1 or 3 sec. Duration may be decided as per fault level.

(K) Reactive compensation:

1. **Shunt capacitors:** Shunt capacitor shall be installed at 33 kV and 11 kV preferably at load centres. In case it is not possible at load centre, then reactive compensation shall be provided in 132 kV systems with a view to meet the reactive power requirement of load close to the load points.

2. **Shunt reactors:** Switch-able shunt reactors shall be provided at 400 kV sub-stations for controlling voltages within the limits specified. The step changes shall not cause a voltage variation exceeding 5%. Suitable Line Reactors (Switch- able/Fixed) shall be provided to enable charging of 400kV lines without exceeding voltage limits specified.

The line reactors shall be installed for long line at high voltage level for curtailing switching over voltage and limiting the fault currents.

3.3.2 To enable the STU to discharge its responsibilities under the transmission license by conducting system studies and preparation of the perspective plans, all the users shall furnish all the data to STU from time to time detailed under Data Registration Section and categorized as planning data (PD), vide Annexure "A". The data pertaining to the generating stations including CGPs and Generating Units owned by distribution licensees working in parallel with grid shall be updated upon any addition of generating unit / modification of the distribution system.

3.3.3 To enable the users to co-ordinate planning, design and operation of their plants and systems with the transmission system they may seek certain salient data of the transmission system as applicable to them. STU/transmission licensee shall apply these data from time to time as detailed under and categorized as Detailed Transmission System Data as per Annexure "B".

3.3.4 In addition to the above provisions, the planning code of the Indian Electricity Grid Code (IEGC) which calls for data exchange shall also apply to the generating companies, transmission licensees, utilities and distribution licensees regarding generation / transmission of energy from inter state transmission systems.

3.3.5 The one time data as per Annexure "A" and "B" shall be submitted within 3 months from the date the Grid Code comes into effect, by all the concerned, to the STU.

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CHAPTER : 4
CONNECTIVITY CONDITIONS

4.1 Connection points/ interface points:

4.1.1 Generating Stations: The voltages at which a generating station may be connected with the STU can be 440, 220, 132 or 33 KV. The connection point/interface point shall be the line isolator of the feeder, which injects power into the transmission system .The isolator shall be under the jurisdiction of the generating station/ CGP. The metering point shall be the incoming feeder gantry of EHV substation. All the protection and metering equipment within the periphery of the generating plants/ CGP shall be owned and maintained by the generating plants/ CGP. From the injection point onwards, the transmission licensee shall maintain all the equipment.

4.1.2 A new generating plant including CGP whose installed capacity is 10 MVA/9 MW and above shall have connectivity through independent/dedicated EHV feeder with EHV sub-station for the purpose of availing start-up power and evacuation of power. Existing generator whose installed capacity is 10 MVA/9 MW and above will also have to have connectivity through independent/ dedicated 132 KV feeder with EHV sub-station for availing startup power and evacuation of power within one year from the date of coming this code in force. CSEB shall examine all such cases and issue notices to them to have connectivity with EHV substation through independent/dedicated EHV feeder and shall issue demand note/ advice to them within three months and the generator shall complete the formalities for having connectivity with the EHV sub station including payment within two months.

4.1.3 A new generating plant including a CGP whose installed capacity is below 10 MVA/ 9 MW shall have connectivity through independent/dedicated feeder at minimum voltage of 33 KV with EHV sub-station, for availing startup power and for evacuation of power. Existing generator/CGP whose installed capacity is below 10 MVA/9 MW shall have to have connectivity through independent/ dedicated feeder with minimum voltage at 33 KV with EHV substation for the purpose of startup power and evacuation of power within one year from the date of coming this code in force. CSEB shall examine all such cases and issue notices to them to have connectivity with EHV substation through independent/dedicated EHV feeder and shall issue demand note/ advice to them within three months and the generator shall complete the formalities for having connectivity with the EHV sub-station including payment within one month. If the bay extension is not possible at the existing substation then the Transmission licensee may set up new substation at the cost of user(s)..

4.1.4 An existing generating plants covered under clause 4.1.2 and 4.1.3 shall be subject to load-shedding plan of CSEB as and when enforced, till their connectivity with the EHV sub station through independent / dedicated feeder

4.1.5 Distribution licensee The connection point / interface point shall be the outgoing feeder gantry of transmission licensee's sub-station. The metering point shall be at 33 or 11 kV side of EHV power transformer at transmission licensee's sub-station. However, the metering point shall be at the outgoing feeders of substation for supply to two or more distribution licensees from the same substation. The connection point/ interface point of the transmission system and metering point shall be incoming feeder gantry of distribution licensee's sub-station, when the voltage at the connection point/ interface point is 132kV or above. All the terminal equipments for communication, protection and metering within the premises of the transmission licensee shall be owned and maintained by the transmission licensee. The respective distribution licensees shall maintain all the equipments from the connection point / interface point onwards.

4.1.6 Connections with other transmission systems: The connection, metering and protection scheme, metering point and the voltage for the Western Regional Transmission System shall be in accordance with the agreement between the CTU and STU / transmission licensee. The connection for other neighboring state transmission systems or any other transmission licensee shall also be in accordance with the agreement between the concerned licensees.

4.2 Procedure for applications for connection to the transmission system:

4.2.1 Any **generator/CGP/Discom/Open access customer** seeking to establish new or modified arrangements for connection to and/or use of the transmission system shall submit an application along with the following information to the STU/transmission license and deposit the prescribed fee as decided by CSERC duly observing the procedural requirements:

(a) The purpose of the proposed connection and/or modification, connecting site, description of apparatus to be connected or modification to the apparatus already connected;

(b) applicable data along with the data listed in the Annexure A and B.

(c) confirmation that the prospective installation complies with the provision of IE Rules, 1956, or rules as may be made under the Electricity Act, 2003;

(d) construction schedule and target completion date;

(e) an undertaking to the effect that the user shall abide by the Grid Code, IEGC and the provisions of IE Rules 1956, or the rules as may be made under Electricity Act, 2003, for installation and operation of the apparatus; and

(f) for special loads like arc furnaces, rolling mills, etc., active and reactive power values of the load with time and harmonic level if the values are not within the permissible limits then such load shall be connected with static var compensator (SVC) to the STS.

4.2.2 The transmission licensee shall make a formal offer to the user within fifteen days from the date of receipt of application. The break-up of costs of the works to be undertaken shall be furnished duly classified under the sub-heads like materials, labour and supervision. The offer made shall be subject to obtaining or in compliance with, the required consents, approvals, permissions for right of way or other requirements, whether of statutory or contractual nature or otherwise.

4.2.3 An user whose development requires the transmission licensee to obtain any consent, approval, permission, and right of way or to comply with any other requirements mentioned in this Code shall:

(a) provide necessary assistance, supporting information or evidence; and

(b) ensure attendance by such witnesses as the transmission licensee may reasonably request.

4.2.4 The estimated time schedule for completion of such works should also be worked out taking into account the time required to obtain statutory clearances etc., wherever necessary. In respect of offers for modifications to the existing connections, the offers shall also take into account the terms of the existing connection agreement.

4.2.5 If the nature or complexity of the proposed development is such that the prescribed time limit for making the offer is not considered adequate, the transmission licensee shall make a preliminary offer within the prescribed time limit indicating the extent of additional time required for more detailed analysis of the issues.

i. On receipt of the preliminary offer, the user shall indicate promptly whether the transmission licensee should proceed further to make a final offer within the extended time limit.

ii. If necessary, the transmission licensee may require the user to furnish some or all of the detailed planning data at this stage itself in advance of the normal time limit.

4.2.6 All offers (other than the preliminary offers) including revised offers shall remain valid for 120 (one hundred and twenty) days from the date of issue of the offer. The transmission licensee shall make a revised offer, upon request by a user, if necessitated by changes in data furnished earlier by the user.

4.2.7 The user shall furnish the relevant detailed planning data to the transmission licensee within thirty days of acceptance of an offer or such longer period as the transmission licensee may agree in a particular case.

4.2.8 Wherever the State power grid is connected to the Inter-State transmission system, the provisions relating to connection conditions of IEGC will prevail.

4.3. **General principles and conditions for grid connectivity: -**

Grid connectivity shall be generally provided subject to the following conditions : -

(1) All users or prospective users are treated equitably.

(2) Any new connections shall not have any adverse effect on the existing users, nor shall a new connection suffer adversely due to existing users.

(3) A system of acceptable quality is ensured by specifying the required minimum standards for the design and operational criteria to assist the users to comply with the license obligations.

(4) The ownership and responsibility for all equipments is clearly specified in the "site responsibility schedule" for every site where a connection is made.

(5) Interconnection of a 132 KV to 400 KV AC sub-station, with (depending on the bus configuration) the transmission and generator feeder lines each terminated into bays containing one or more breakers.

(6) The paralleling of generator / captive generators would be allowed only after ensuring proper protection schemes adopted by the captive generators on inter-connecting feeders and proper operational measures (provision of sectionalize, breaker etc. at generators end). The list of protecting devices and equipments to be installed at generator end on the interconnecting feeders would be indicated by the STU/ transmission licensee.

(7) The paralleling of generator / captive generators with STU may have to pay parallel operation charges to the concerned STU, as may be decided by the Commission from time to time.

(8) The user shall not force changes in maintenance schedules of utilities in the grid, due to constraints arising in his system during grid operation.

(9) All generators (including CGP) will make adequate arrangement for isolation and islanding of their unit(s) in case of system distress conditions.

(10) Depending on the requirement of the system, the generator/ captive generating plant will provide adequate reactive power to the system matching with the active power supply subject to the designed limitations specified by the manufacturer.

(11) In case of low frequency, the total spinning reserve capacity available with the generators should be brought in to operation for maximizing their generator/captive power generation.

(12) Under extreme emergencies captive generator(if not injecting power)/consumers may also be required to do under frequency load shedding.

(13) For scheduling and dispatching of demand/drawal/bilateral exchanges etc, the CGPs will be treated at par with the other generators.

(14) The user shall take care of modification of equipment ratings, if any, of both his system and grid connection point equipments arising due to connectivity modification.

(15) The user shall satisfy protection standards and relay coordination aspects at the connection point as per overall grid norms. Such co-ordination settings will be evolved in the Protection Committee of WRPC.

(16) The user shall provide tele-metering, SCADA and other relevant data at the points of interconnection to concerned user(s) and RLDC/SLDC if required by RLDC/SLDC, to facilitate the grid operation.

(17) The user shall take care of his system in the event of grid initiated disturbances and not rely on grid defense mechanisms alone.

(18) The user shall ensure sensitive and reliable protection for fast opening and isolation of his utility from the grid interconnection due to disturbances initiated from his system.

(19) The user shall take part in islanding and other grid schemes by contributing generation/load wherever available, as decided by the SLDC, The applicant shall follow load restoration guidelines during islanded operation as per instructions of the RLDC/SLDC.

(20) The user shall help the grid by supplying start-up power if he has generating sources in his area as per RLDC/SLDC instructions.

(21) The user shall give concerned protection tripping data in the events of grid disturbances to SLDC for analysis for ensuring safe and reliable grid operation.

(22) Grid shall help the user in the event of his system failures, by way of assistance for start up power and restoration by RLDC/SLDC.

(23) The user shall ensure safety standards and operating procedure during maintenance of common portion by other utility personnel, including line permits and allowing locking of isolator in open position to prevent accidental charging.

(24) The user shall ensure proper tele-metering, accessibility by express communication, so that grid inter-connectivity data is made available to all concerned.

(25) The user shall ensure that proper energy meters as per metering code.

(26) The user shall perform testing/calibration of equipments and energy meters at inter connection points in presence of interested parties and concerned utilities and make available test reports of such periodic testing to interested parties and concerned utilities/organizations including SLDC.

(27) The user shall plan maintenance schedule of lines/inter connecting transformers (ICTs) or bay at connection point in consultation with the SLDC/STU.

(28) In exceptional circumstances of system operation, RLDC/SLDC will have the right of postponing a maintenance schedule in the user's system if adverse conditions exist. This will however be an exception and not rule.

(29) The user shall satisfy such other prevalent norms of equipment and personnel safety, equipment protection and grid operation code, environment safety norms and such other national policies which are not listed here in this document.

(30) The user shall share information whenever his system adopts and follows higher than prescribed norms/standards in respect of equipment protection, grounding and other operation/protection standards and human safety as given by the STU and CEA so that grid and nation may benefit from the improved standards.

(31) Training of sub-station/line staff at the interconnection of both utilities (user and existing utility of tie points) with respect to safety and operation procedures to be conducted annually and on mutually agreed dates.

(32) The user shall not energize a dead utility connection unless permitted by RLDC/SLDC.

4.4 Telemetry Requirements: -

The following includes specific requirement based on the project size:

a. Telemetry is required for more than 1 MW capacity project and all open access customer.

b. Station service load may require separate telemetry if it comes from a different Load Control Area. Telemetry of active and reactive power , energy (KW, KWh, KVAr, KVArh),Voltage(KV) and other parameters such as Breaker, status & Control etc is normally required.

4.5 Safety

At the point of interconnection to the grid an isolating device, which is typically an isolator/ disconnect switch, shall be provided that physically isolates the grid from the project. Safety and operating procedures for the isolating device shall be in compliance with the standards of safety as laid down by the Authority under Section 73(c) of the Act. The project operator shall visibly mark all switchgear that could leave equipment energized, so that all maintenance crews are aware of the potential hazards. The isolating device may be placed in a location other than the point of interconnection, by agreement of CTU/STU and affected parties. In any case the device:

(ii) must simultaneously open all phases (gang-operated) to the project;

(iii) must be accessible by CTU/STU and under ultimate RLDC/SLDC jurisdiction;

(iv) must be lockable in the open position by CTU/STU;

(v) would not be operated without advance notice to either party, unless an emergency condition requires that the device be opened to isolate the project;

(vi) must be suitable for safe operation under the conditions of use; and

(vii) may be locked by CTU/STU personnel in the open position and install safety boards:

(a) if it is necessary for the protection of maintenance personnel when working on de-energized circuits;

(b) if the project or CTU/STU equipment presents a hazardous condition;

(c) if the project or CTU/STU equipment interferes with the operation of the grid;

(d) if the grid interferes with the operation of the project.

Since the device is primarily provided for safety and cannot normally interrupt load current, consideration shall be given as to the capacity, procedures to open, and the location of the device.

4.6 Other Considerations

4.6.1 Equipment for Grid connectivity of generating unit shall be in conformity with the following requirements:

The overall system shall be designed considering maximum voltage variation of +/- 5% and fault level of 40KA for 400KV system.
Frequency variation shall be +3 to -5% and combined voltage and frequency variation shall be 10%.
Equipment shall be suitable for 50 °C ambient.

Generator

Voltage Variation	±7.5% continuously at rated power factor. Reduced MVA operation at 110% of the rated voltage.
Frequency Variation	47.5 HZ. To 51.5. Hz.
Combined voltage and frequency variation	± 5%
Power Factor variation	0.85 (lag) to 0.95 (lead)
Operation under unbalanced load	As specified in IEC 34-1
Short circuit ratio	As per IEC 34-1
Operation under unsymmetrical short circuit	Negative sequence current I_2 expressed in per unit of rated current for a duration of 't' second such that the value of $(I_2)^2t$ shall comply to IEC 34-1
Voltage Wave form	The total harmonic factor (T.H.F.) shall be within the limit specified in IEC 34-1
Short Circuit withstanding capacity	Capable of withstanding of 3 phase short circuit at the generator terminals when operating at rated MVA and power factor with 5% over voltage for a period of not less than 3 seconds.
Special operating conditions	Capable of withstanding the electrical mechanical and thermal stresses developed during fast reclosing of high voltage line, transmission line switching, faults, out of step operation and out of phase synchronization etc.
Line charging capability	Not less than 30% of its rated MVA at zero pf.

Excitation:

A) Characteristics: The excitation system shall have matching characteristics suitable for satisfactory parallel operation with other generator in the plant.

B) Equipment design and sizing criteria:

General	When the generator is subjected to a sudden loss of rated output at rated power factor, the system shall be capable of restoring the voltage of within 2% of the nominal preset value within negligible time, so as not to initiate the protection equipment.
b) Excitation system response time as per IEEE 421 A	<0.5 sec.
c) Excitation response ratio	>2
d) Excitation system ceiling voltage	> 1.5 times rated load excitation voltage
e) Field forcing capability	Each excitation system channel shall be capable of supplying without damage to any of the components, the field forcing voltage and current of the system for a period of 10 seconds without exceeding the limits of temperature
f)Power System Stabilizer	Power System Stabilizers (PSS) shall be suitable for damping the various models of electro-mechanical oscillations at all frequencies in the rage of 0 to 3 Hz. under varying generator loading and power system network considerations. PSS shall be adaptive to varying operating conditions with features to compute optimum stabilizing signal along with suitable scheme for identifying external reactance of the generator. Facility for remote manual switch off-on alongwith indication shall be incorporated. Automatic supervision and blocking/switch off facility alongwith indications etc. shall be provided.
g) Rotor angle limiter	A rotor angle limiter shall be incorporated in the system. This shall enable to keep the angle between the direct axis of the machine and network vector within the set reference value as determined by stability by adjusting the excitation.
h)Stator current limiter	The stator current limiter shall act immediately in under excited range. The time delay in over excited range shall enable a temporary overloading of the machine.
i) Rotor current limiter	The regulator shall act with time delay, so that the regulation dynamics are not impaired in case of a fault
j) Voltage/frequency(V/Hz) limiter	To limit the ratio of generator voltage and frequency at all operating conditions to such a value that the maximum generator transformer core flux density does not exceed the value specified
k) HV Switchyard should be suitable for the following parameters	
i) X/R Ratio of the system	14
ii) Design BIL	400kV 220kV 132kv 1425kVp 1050 kVp 650kVp
iii) Lightning Arrester voltage rating in kVrms	336, 198, 120
iv) Requirement of protection	Main-I & Main-II distance protection on outgoing lines.
v) Requirement of metering	0.2S accuracy metering class
vi) Requirement of load shedding, islanding	Required
vii) Earth mat design criteria	40 kA 1 sec.

Existing electrical equipment in the CTU/STU system, such as transformers, power circuit breakers, disconnect switches, arresters and line conductors shall be installed based on the duties expected in response to system additions identified in long-term plans. However, with the interconnection of a new generating resource, some equipment may become under-rated and need to be replaced.

4.6.2 System Stability and Reliability

The CTU/STU system has been developed with careful consideration for system stability and reliability during disturbances. The size of the project, breaker configurations, generator characteristics, and the ability to set protective relays will affect where and how the point of interconnection is made. The project may also be required to participate in special protection schemes (remedial action) such as load dropping.

4.6.3 Control and Protection

CTU/STU coordinates its protective relays and control schemes to provide for personnel safety and equipment protection and to minimize disruption of services during disturbances. Project interconnection usually requires the addition or modification of protective relays and/or control schemes. New projects must be compatible with existing protective relays schemes. Sometimes, the addition of voltage transformers (VTs), current transformers (CTs), or pilot scheme (transfer trip) also are necessary, based on the point of Interconnection.

4.6.4 Dispatching and Maintenance

RLDC/SLDC operates the grid to provide reliable customer service while meeting the seasonal and daily peak loads even during equipment outages and disturbances. Project integration requires that the equipment at the point of interconnection not restrict timely outage coordination, automatic switching or equipment maintenance scheduling. Preserving reliable service is essential and may require additional switchgear, equipment redundancy, or bypass capabilities at the point of interconnection for acceptable operation of the system.

The generator will be expected to supply up to maximum available reactive capability and / or to adjust generation levels including reducing to zero if required by the RLDC/SLDC. This will always be for reliability purposes only in exigencies.

4.6.5 Atmospheric and seismic conditions

The effects resulting from windstorms, floods, lightning, elevation, temperature extremes and earthquakes must be considered in the design and operation of the project. The user(s) will be responsible for determining that the appropriate standards, codes, criteria, recommended practices, guides and prudent utility practices are met with.

4.7 Site responsibility schedule

4.7.1 For every connection to the transmission system for which a connection agreement is required, the transmission licensee shall prepare a schedule of equipment, pursuant to the relevant connection agreement, with the information supplied by the Users. This schedule, called a Site Responsibility Schedule, shall state the following for each item of equipment installed at the connection point:

(ii) the ownership of the plant/apparatus;

(iii) the responsibility for control of plant/apparatus;

(iv) the responsibility for operation of plant/apparatus;

(v) the responsibility for maintenance of plants/apparatus;

(vi) the responsibility for all matters relating to safety of person at the connection/ interface point; and

(vii) the management of the connection/ interface point.

4.7.2 Each site responsibility schedule, in addition to the above, shall contain all other information setout in the Grid Code. An illustrative "Site Responsibility Schedule" is furnished in Annexure "C".

4.7.3 The user owing the connection / interface site shall provide reasonable access and other required facilities for other users whose equipments are installed or to be installed at the connection/interface site for installation, operation and maintenance etc.

4.7.4 Single Line Diagrams

i) Single Line Diagram shall be furnished for each Connection Point by the users to SLDC. These diagrams shall include all HV connected equipment and the connections to all external circuits and incorporate numbering, nomenclature and labeling, etc. The diagram is intended to provide an accurate record of the layout and circuit connections, rating, numbering and nomenclature of HV apparatus and related plant.

ii) Whenever any equipment has been proposed to be changed, then concerned agency shall intimate the necessary changes to STU and to all concerned. When the changes are implemented, changed Single Line Diagram shall be circulated by the agency to SLDC/STU.

4.7.5 Site Common Drawings

i) Site Common Drawing will be prepared for each Connection Point and will include site layout, electrical layout, details of protection and common services drawings. Necessary details shall be provided by the users to STU.

ii) The detailed drawings for the portion of the user and STU/transmission licensee at each Connection Point shall be prepared individually and copies shall be exchanged between user and STU.

iii) If any change in the drawing is found necessary, the details will be exchanged between users and STU as soon as possible.

4.8 System Performance

4.8.1 The design and construction of all the equipment connected to the transmission system shall satisfy the relevant Indian standard specifications. In case of equipment for which the Indian Standard Specifications do not exist, the appropriate IEC, or IEEE or other International Standards shall apply.

4.8.2 Installation of all electrical equipment shall comply with IE Rules, 1956 which are in force for the time being and will be replaced by new rules to be made under Electricity Act, 2003.

4.8.3 For every new connection sought, the transmission licensee shall specify the connection point/interface point and the supply voltage, alongwith the metering requirements as specified in the Metering Code .

4.8.4 Supervisory control and data acquisition (SCADA):

4.8.5 The transmission licensee shall install and make operative an Operational metering data collection system under SCADA for storage, display and processing of operational metering data. All users shall make available outputs of their respective operational meters to the SCADA interface equipment for display at the SLDC.

4.9 Protection requirement:

4.9.1 No item of electrical equipment shall be allowed to remain connected to the system unless it is covered by the appropriate protection aimed at reliability, selectivity, speed and sensitivity. The guidelines mentioned in the "Manual on protection of generators, generator transformers, and 220kV and 400kV networks" vide publication No. 274 of C.B.I.P. shall be kept in view. All the generating companies and the distribution licensees shall cooperate with the transmission licensee to ensure correct and appropriate settings of protection to achieve effective, discriminatory isolation of faulty line / equipment within the target clearance times specified elsewhere in this standard.

4.9.2 Protection settings shall not be altered, or protection bypassed and/or disconnected without consultation with the users. In case the protection has been bypassed and/or disconnected by agreement due to any cause, the same should be rectified and protection restored to normal conditions as quickly as possible. If agreement has not been reached, the electrical equipments shall be isolated forthwith.

4.10 Protection coordination

4.10.1 The settings of protective relays starting from the generating unit upto the remote end of 132 kV/ 33kV and 11 kV line shall be such that only the faulty section is isolated under all circumstances. The transmission licensee shall notify the initial settings and any subsequent changes to the users from time to time. Routine checks on the performance of the protective relays shall be conducted and any malfunction shall be noted and corrected as soon as possible. The transmission licensee shall conduct the required studies for deciding the relay settings, with the data collected from the users. Representatives of all the user(s) shall meet periodically to discuss such malfunctions, changes in the system configuration, if any, and possible revised settings of relays.

4.10.2 The transmission licensee shall be responsible for arranging periodical meetings between the generating companies and the distribution licensees to discuss coordination of protection. The transmission licensee shall investigate any malfunction of protection or other unsatisfactory protection issues. The concerned licensees shall take prompt action to correct any protection malfunction or issue as discussed and agreed to in these periodical meetings.

4.11 Fault clearance time:

4.11.1 From stability considerations the maximum fault clearance time for faults on any user's system directly connected to the transmission systems, or any faults on the transmission system itself, shall be as follows:

Voltage Class	Target clearance time
400kV	100 m sec.
220 kV	120 m sec.
132 kV	160 m sec.

4.11.2 Lesser fault clearance time than the above are preferable.

4.11.3 Lower fault clearance times for faults on a user's system may be agreed to, but only if, in the opinion of the transmission licensee, system conditions allow the same. At the generating stations, line-faults should be cleared at the generating station end, within the critical time, to keep the generators in synchronism.

4.12 Generator requirements

4.12.1 All generating units and all associated electrical equipment of the generating company connected to the transmission system shall be protected by adequate protection, as per CBIP manual vide publication 274, so that the transmission system does not suffer due to any disturbances originating at the generating unit.

4.13 Transmission line requirement:

Every EHT line taking off from a generating station or a sub-station or a switching station shall necessarily have distance protection along with other protections as follows:

a) **400KV lines**: These lines shall have two main distance protections viz. Main I and Main II with permissive inter trip for remote earth fault. Three zone static/numerical non-switched distance protection with permissible inter trip for accelerated tripping at remote end in case of Zone 2 fault as Main I protection shall be provided. Main II protection shall be similar fast protection using direction comparison or phase comparison carrier relay scheme. In addition to the above, single pole tripping and single shot single pole auto reclosing after an adjustable dead time shall be provided. In addition to the above backup protection with directional OCR (Over current relay) and directional EFR (earth fault relay) shall be provided.

b) **220 kV lines**:- Three zone static/numerical non-switched distance protection, with permissible inter trip for end zone fault as main protection in case of zone 2 fault shall be provided. The backup shall be three-phase directional over current relay and earth fault relay protection. Three pole/ single pole tripping with single shot reclosing with adjustable dead time shall be provided for the stability of the power system. However, for short 220 kV lines directional comparison or phase comparison carrier protection as Main II can be provided. In addition to the above backup protection with directional OCR (Over current relay) and directional EFR (earth fault relay) shall be provided.

c) **132 kV lines:-** Three zone static/numerical switched protection with permissible inter trip for accelerated tripping at remote end in case of zone 2 protection shall be provided as main protection. The backup will be directional three-phase over current and earth fault protection.

d) **Busbar protection**: Adequate busbar protection for the station busbar sections in all 400kV and 220kV class substations shall be provided.

e) **Local breaker backup protection (LBB)**:- In the event of any circuit breaker failing to trip on receipt of trip command from protective relay, all circuit breakers connected to the bus section to which the faulty circuit breaker is connected are required to be tripped with minimum possible delay through LBB protection. This protection also provides coverage for faults between the circuit breaker and the current Transformer, which are not covered by other protections. All 220kV and 400kV circuits shall have Local Breaker Backup Protection and also in important 132 kV.

f) **400kV class power transformers**: These shall be provided with differential protection, restricted earth fault protection, Buchholtz protection, over flux ,oil and winding temperature protection along with backup directional HV and LV IDMT over current protection.

g) **200kV and 132kV class power transformers**:- These shall have differential protection, restricted earth fault protection, Buchholtz protection, and winding/oil temperature protection. They shall also have directional over current as backup protection with an instantaneous element. In addition to the above, Over Fluxing Relays, shall be provided for all the power transformers. Appropriate fire protection for all the power transformers as per CBIP specifications shall be provided. Over fluxing relays shall be provided on transformers having rating more than 100 MVA.

h) **Distribution system**: For smaller transformers of HV class on distribution system, differential protection shall be provided for 10 MVA capacity and above along with backup time lag over current and earth fault protection with directional feature for parallel operation. Transformers of 1.6 MVA capacity and above but less than 10 MVA shall be

protected by time lag over current, earth fault and instantaneous restricted earth fault relays. In addition, all Transformers of 1.6 MVA and above shall be provided with Buchholtz relays, winding and oil temperature protection.

i) **Distribution lines**: All the 33KV, and 11 KV lines at Connection points/ interface points shall be provided with a minimum of over current and earth fault relays as follows:-

(i) Plain Radial Feeders: Directional over current and earth fault relays with suitable settings to obtain discrimination between adjacent relay settings.

(ii) Parallel / Ring Feeders: Directional time lag over current and earth fault relay.

4.14 **Inadvertent Flow:** When two systems are operating in parallel with floating tie-line, it may not be possible to have tie line absolutely floating because of dynamics of network parameters and there will be a flow of energy from one system to another system. Such inadvertent flow shall be accounted for the purpose of commercial billing.

4.15 The operation of the transmission system shall be in accordance with the "Transmission system operating standard". The user shall however be subject to the grid discipline prescribed by the SLDC/ WRLDC.

4.16 The insulation coordination of the user's equipment shall conform to the applicable Indian standards/ code of practices. The rupturing capacity of the switchgear shall not be less than that notified by the transmission licensee based on system studies.

4.17 The equipment for data transmission and communications for all the generating stations existing at the time the Grid Code comes into effect shall be owned and maintained by STU/ transmission licensee unless alternative arrangements are mutually agreed to. For new generating stations the same shall be owned and maintained by STU/transmission licenses, unless otherwise mutually agreed to by the generating plants.

4.18 Right to reject an application:

4.18.1 The transmission licensee may reject any application for connection to and/or use of the transmission system under the following conditions:-

1. If the proposed connections violate any provisions under the transmission license.
2. If the proposed works stated in the application do not lie within the purview of the licensee or do not conform to the provisions of the Grid Code.
3. *If the system capacity does not permit.*

4.18.2 In the event of an offer becoming invalid or rejected within the validity period, no further action shall be taken by the STU/transmission licensee on the connection applications unless it is substantially different from the original application with regard to the system changes.

4.19 Connection Agreement

4.19.1 A connection agreement or the offer for a connection agreement, shall include, as appropriate, within its terms and conditions, the following:

a) A condition requiring both parties to comply with the Grid Code,

b) Details of connection and/or use of the system,

c) Details of any capital related payments and any other payments and deposits etc. arising from necessary reinforcement or extension of the system

(d) A "site responsibility schedule" detailing the division of responsibility at the connection sites in relation to ownership, control, operation and maintenance of plant and apparatus and to safety of persons.

4.19.2 If any offer was originally made upon an application for development by a user, which is subject to changes in the design parameters, the transmission licensee shall make a revised offer to the user including revised terms and extended time limit for submission of data. This revised offer shall form the basis of any connection agreement.

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CHAPTER : 5

OPERATION GUIDELINES FOR STATE GRID

5.1 Operation Policy:

a) The primary objective of integrated operation of the State grid is to enhance the overall operational economy and reliability of the entire electric power network spread over the geographical area of the State.

b) Overall real time operation of the State grid shall be supervised from the State Load Dispatch Centre (SLDC). The role of SLDC and STU shall be in accordance with the provisions of this code.

c) All State entities shall comply with these operation guidelines and coordinate with each other, for deriving maximum benefits from the integrated operation and for equitable sharing of obligations.

d) A set of detailed internal operating procedures for the State grid shall be developed and maintained by the SLDC in consultation with the State entities which shall be consistent with State grid and IEGC.

e) The control rooms of the SLDC, SSLDCs, power plants, HV and EHV sub-stations and any other control centres of all State entities shall be manned and maintained round the clock by qualified personnel with adequate training.

5.2 System Security Aspects:

a) All user(s) and all the other constituent participating in the State grid shall endeavour to operate their respective power systems and power stations synchronous with each other at all times, such that the entire system within the State operates as one synchronized system.

b) No part of the grid shall be deliberately isolated from the rest of the State grid, except:

(i) Under an emergency, and conditions in which such isolation would prevent a total grid collapse and / or enable early restoration of power supply;

(ii) when serious damage to a costly equipment is imminent and such isolation would prevent it; and

(iii) when such isolation is specifically instructed by SLDC.

Complete synchronization of grid shall be restored as soon as the conditions again permit it. The restoration process shall be supervised by SLDC, as per operating procedures separately formulated.

c) No important element of the State grid shall be deliberately opened or removed from service at any time, except when specifically instructed by SLDC or with specific and prior clearance of SLDC. The list of such important grid elements on which the above stipulations apply shall be prepared and be available at SLDC/SSLDCs. In case of opening/removal of any important element of the grid under an emergency situation the same shall be communicated to SLDC at the earliest possible time after the event.

d) Any tripping, whether manual or automatic, of any of the above elements of State grid shall be precisely intimated by the concerned State entities to SLDC as soon as possible. The reason (to the extent determined) and the likely time of restoration shall also be intimated.

e) All generating units, which are synchronized with the State grid irrespective of their ownership, type and size, shall have their governors in normal operation at all times. If any generator of over 50 MW rating is required to be operated without its governor in normal operation the SLDC shall be immediately advised about the reason and duration of such operation. All governors shall have a droop between 3% and 6%.

f) Facilities available in load limiters, automatic turbine run up system (ATRS), turbine supervisory control, coordinated control system, etc., shall not be used to suppress the normal governor action in any manner. No dead bands and/or time delays shall be deliberately introduced.

g) All generation units, operating at/up to 100% of their maximum continuous rating (MCR) shall normally be capable of (and shall not in any way be prevented from) instantaneously picking up five percent (5%) extra load for at least five (5) minutes or within technical limits prescribed by the manufacturer when frequency falls due to a system contingency. The generating units operating at above 100% of their MCR shall be capable of (and shall not be prevented from) going at least up to 105% of their MCR when frequency falls suddenly. Any generating unit of over fifty (50) MW size, not complying with the above requirement, shall be kept in operation (i.e., synchronized with the State grid) only after obtaining the permission of SLDC. However, the entity can make up the corresponding shortfall in spinning reserve by maintaining an extra spinning reserve on the other generating units of the entity.

h) The recommended rate for changing the governor setting, i.e. supplementary control for increasing or decreasing the output (generation level) for all generating units, irrespective of their type and size, would be one (1.0) percent per minute or as per manufacturer's limits. However, if frequency falls below 49.5 Hz, all partly loaded generating units shall pick up additional load at a faster rate, according to their capability.

i) Except under an emergency, or to prevent an imminent damage to personnel and equipment, no entity shall suddenly reduce his generating unit output by more than one hundred (100) MW without prior intimation to, and consent of the SLDC, particularly when frequency is falling or is below 49.0. Similarly, no entity shall cause sudden increase in its load by more than one hundred (100) MW without prior intimation to and consent of the SLDC.

j) All generating units shall normally have their AVRs in operation, with appropriate settings. In particular, if a generating unit of over fifty (50) MW size is required to be operated without its AVR in service, the SLDC shall be immediately intimated about the reason and duration, and its permission obtained.

k) Provision of protections and relay settings shall be coordinated periodically throughout the State grid, as per a plan to be separately finalized by the STU in coordination with all entities.

l) All user(s) shall make all possible efforts to ensure that the grid frequency always remains within the 49.0–50.0 Hz band, the frequency range within which steam turbines conforming to the IEC specifications can safely operate.

m) All user(s) shall provide automatic under-frequency & df/dt load shedding in their respective systems, to arrest frequency decline that could result in a collapse/ disintegration of the grid, as per the plan separately finalized by STU, and shall ensure its effective application to prevent cascaded tripping of generating units in case of any contingency. All State entities shall ensure that the under-frequency & Df/Dt load shedding/islanding schemes are functional and no under-frequency relay is by-passed or removed without prior consent of SLDC.

n) All user(s) shall facilitate identification and commission the systems protection schemes (including inter-tripping and run-back) in the power system to protect against situation such as voltage collapse and cascading . Such schemes would be finalized by the STU, and shall be kept in service. SLDC shall be promptly informed in case any of these are taken out of service.

o) STU/ generating units will make the islanding scheme for emergency supply.

p) All generating units will ensure HT/LT by-pass arrangement wherever provided to be in service so, that at least one of the generator service in house load.

q) Procedures shall be developed to recover from partial / total collapse of the grid and periodically updated in accordance with the requirements given under. These procedure shall be followed by all the user(s) to ensure consistent, reliable and quick restoration.

r) Each user(s) shall provide adequate and reliable communication facility internally and with other entities/SLDC to ensure exchange of data/information necessary to maintain reliability and security of the grid. Wherever possible, redundancy and alternate path shall be maintained for communication along important routes, e.g. SLDCs or SSLDCs and generation stations.

s) The user(s) shall send information / data including disturbance recorder / sequential even recorder output etc., to SLDC for purpose of analysis of any grid disturbance / event. No user(s) shall block any data/information required by the SLDC for maintaining reliability and security of the grid and for analysis of an event.

t) All user(s) shall make all possible efforts to ensure that the grid voltage always remains as per the clause 3.3.1 (F) .

u) 400/220 kV & 220/132 kV I.C.T's. tap operation will be done only after approval from WRLDC and SLDC respectively.

v) Any switching operation on 400 kV will be done after intimation & approval by WRLDC/ SLDC.

w) Single substation capacity shall be limited as per the clause 3.3.1 (J).

5.3 Demand Estimation For Operational Purposes:

Each SLDC shall develop methodologies / mechanisms for daily/weekly/ monthly / yearly demand estimation (MW, MVAR and MWH) for operational purposes. The data for the estimation shall not include load shedding, power cuts, etc., SLDCs shall also maintain historical database for demand estimation. The demand estimates are to enable the SLDC to conduct system studies for operational planning purpose.

5.4 Demand Control:

The provisions to be made by SLDC to permit the reduction of demand in the event of insufficient generating capacity, and transfers from external interconnections being not available to meet demand, or in the event of breakdown or operating problems (such as frequency, voltage levels or thermal overloads) on any part of the grid.

Manual Demand Disconnection: -

(a) As mentioned elsewhere, the user(s) shall endeavour to restrict their net drawal from the grid within their respective drawal schedules whenever the system frequency is below 49.5 Hz., When the frequency falls below 49.0 Hz., requisite load shedding (manual) shall be carried out to curtail the overdrawal. Such load shedding shall be pre planned for each level of under frequency.

(b) Further, in case of certain contingencies and/or threat to system security, the SLDC may direct the SSLDCs and other sub-stations to decrease its drawal by a certain quantum. Such directions shall immediately be acted upon.

(c) Each user(s) shall make such arrangements as will enable manual demand disconnection to take place, as instructed by the SLDC/SSLDC, under normal and / or contingent conditions.

(d) The measures taken to reduce the user(s) drawal from the grid shall not be withdrawn as long as the frequency/voltage remains at a low level, unless specifically permitted by the SLDC/SSLDC.

(ii) **Load Shedding Policy :**

1. In case of shortage of power availability with respect to demand, the SLDC shall resort to shedding the load of different feeders on economic principle till the Commission specifies any policy in this regard.
2. SLDC will monitor, regulate and submit report to the Commission as per Commission's order under section 23 of the Act.

5.5 Periodic Reports:

(i) A weekly report shall be issued by SLDC to all usre(s) of the State and STU and shall cover the performance of the State grid for the previous week. The weekly report shall contain the following:

a) Frequency profile: maximum and minimum frequency recorded daily and daily frequency variation index (FVI);

b) voltage profile: the voltage profile of selected sub-stations;

c) major generation and transmission outages;

d) transmission constraints; and

e) instances of persistent/significant non compliance of the Grid Code.

(ii) Other Reports:
The SLDC shall also prepare a quarterly report which shall bring out the system constraints, reasons for not meeting the requirements, if any of security standards and quality of service, along with details of various actions taken by different agencies, and the agencies responsible for causing the constraints.

5.6 Operational Liaison:

This section sets out the requirements for the exchange of information in relation to operations and / or events on the total grid system which have had or will have an effect on:

the State grid;

inter-State links; and

the system of a State entity.

The above generally relates to notifying of what is expected to happen or what has happened. The operational liaison function is a mandatory built-in hierarchical function of the SLDC and user(s), to facilitate quick transfer of information to operational staff. It will correlate the required inputs for optimization of decision-making and actions.

5.6.1 Procedure for Operational Liaison :

(a) Operations and events on the State grid:

Before any operation is carried out on State grid, the SLDC will inform each entity, whose system may, or will experience an operational effect, and give details of the operation to be carried out. Immediately following an event in the State grid, the SLDC will inform each user, whose system may, or will, experi ence an operational effect, following the event, details of what has happened in the event.

(b) Operations and events on an user(s) system:

Before any operation is carried out on an user(s) system, the user(s) will inform the SLDC, in case the State grid may, or will experience an operational effect, and give details of the operation to be carried out. Immediately following an event on the user(s) system, the user(s) will inform the SLDC, in case the State grid may, or will, experience an operational effect following the event and give details of what has happened in the event.

(c) For recharging of tripped ICT 400/220 Kv or 220/132 Kv, the permission from the CE/SE (Testing) shall be obtained.

5.7 Outage Planning:

5.7.1 General:

(i) This part sets out the procedure for preparation of outage schedules for the elements of the State grid in a coordinated and optimal manner keeping in view the State system operating conditions and the balance of generation and demand. List of elements of grid covered under these stipulations shall be prepared and be available with SLDC.

(ii) The objective of this sections are:

- To produce a coordinated generation outage programme for the State grid, considering all the available resources and taking into account transmission constraints, as well as irrigational requirements.

- To minimize surplus or deficits, if any, in the system requirement of power and energy and help operate the system within security standards.

- To optimize the transmission outages of the elements of the State grid without adversely affecting the grid operation but taking into account the generation outage schedule, outages of constituent systems and maintaining system security standards.

(a) The generation output and transmission system should be adequate after taking into account the outages to achieve the security standards.

(b) Outage planning is prepared in advance for the current year and reviewed during the year on quarterly and monthly basis.

(c) This section is applicable to all state entities including SLDC, STU, generating and transmission companies.

5.7.2 Interfaces and Responsibilities:

(a) The SLDC is responsible for analyzing the outage schedule given by all State entities, preparing a draft outage schedule and establishment of final plan for current year by July of current year.

(b) The outage plan will be reviewed by the STU.

(c) Demand estimation is necessary both in the long time scale to ensure adequate system plant margins and ratings and in the shorter time scale to assist with frequency control. Discom shall provide to the STU their estimates of demand at each inter-connection for the desired period on a year ahead, month ahead and day ahead basis as required. Based on this, the STU shall make monthly peak and lean period demand estimates for the year ahead, daily peak and lean period demand estimates for the month ahead and hourly demand estimates for the day ahead. STU shall use hourly generation summation figures and import/export figures to meet the demand estimation, distribution companies shall provide to SLDC estimates of load that may be shed, when required, in discrete blocks with the details of the arrangements of such loadshedding. All data shall be collected in accordance with procedures agreed between the STU and each constituent. SLDC shall maintain a database of State demand on an hourly basis.

5.7.3 Outage Planning Process:

a) The STU and generating plants shall provide the SLDC their proposed outage programers in writing for the next year by the end of the month of July of the current year. These shall contain identification of each generation unit / line/ ICT, the preferred date for each outage and its duration and where there is flexibility, the earliest start date and latest finishing date.

b) SLDC shall then come out with a draft outage programme for the next year by the end of the month of September of the current year for the State grid taking into account the available resources in an optimal manner and to maintain security standards. This will be done after carrying out necessary system studies and, if necessary, the outage programmes shall be rescheduled. Adequate balance between generation and load is to be ensured while finalizing outage programme.

c) This next year plan shall be intimated to all user(s) for implementation latest by the end of the month of November or by such earlier date as may be decided by STU.

d) This next year's plan shall be reviewed by SLDC/STU on quarterly and monthly basis in coordination with all parties concerned

e) In case of emergency in the system viz. loss of generation, break down of transmission line affecting the system, grid disturbance, system isolation, SLDC may conduct studies again before clearance of the planned outage.

f) SLDC is authorized to defer the planned outage in case of any of the following:

(i) Major grid disturbance;

(ii) system isolation;

(iii) black out in a constituent system; and

(iv) any other event in the system that may have an adverse impact on the system security by the proposed outage.

g) Each State entity shall obtain the final approval from SLDC prior to availing an outage.

5.8 Recovery Procedures:

b) Detailed plans and procedures for restoration of the grid under partial / total black out shall be developed by SLDC in consultation with all State entities and shall be reviewed / updated annually.

c) Detailed plans and procedures for restoration after partial /total black out of each constituent's system within the State, will be finalized by the concerned entity in coordination with the SLDC. The procedure will be reviewed, confirmed and / or revised once every year.

d) List of generating plants with black start facility, inter-state synchronizing points and essential loads to be restored on priority, should be prepared and be available with SLDC.

e) The SLDC is authorized during the restoration process following a black out, to operate with reduced security standards for voltage and frequency as necessary in order to achieve the fastest possible recovery of the grid.

5.9 Event Information:

(i) This part deals with reporting procedures in writing of reportable events in the system to all user(s) and SLDC. The objective of this section is to define the incidents to be reported, the reporting route to be followed and information to be supplied to ensure consistent approach to the reporting of incidents/events.

(ii) **Responsibility**: The SLDC/SSLDC shall be responsible for reporting events to the STU. All users are responsible for collection and reporting of all necessary data to SLDC for monitoring, reporting and event analysis.

(iii) **Reportable Events**:
Any of the following events require reporting by SLDC / user to the STU:

- Violation of security standards.
- Operational Indiscipline.
- Non-compliance of instructions.
- System islanding / system black out.
- State black out / partial system black out.
- Protection failure.
- System instability.
- Tripping of any element of the EHV State grid.
- Major Equipment failure.

iv) **Reporting Procedure**:

- Written reporting of events by State entities to SLDC.

  In the case of an event which was initially reported by a State entity to SLDC orally, the entity will give a written report to SLDC in accordance with this section.

- Written reporting of events by SLDC to State entities.

  In the case of an event which was initially reported by SLDC to a entity orally, the SLDC will give a written weekly report to the entity in accordance with this section.

v) **Form of Written Reports**:

A written report shall be sent to SLDC or a user(s), as the case may be, and willconfirm the oral notification together with the following details of the event:

- Time and date of event.
- Location
- Plant and / or Equipment directly involved
- Description and cause of event
- Demand and / or Generation (MW) interrupted and duration
- All relevant system data including copies of records of all recording instruments including Disturbance Recorder, Event Logger, DAS etc.,
- Sequence of trippings with time.
- Details of Relay Flags.
- Remedial measures.

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CHAPTER : 6

SCHEDULING AND DISPATCH

6.1 This section deals with the procedure to be adopted for scheduling of generation by State sector generating plants, CGPs, of share from Central sector generating station for scheduling of drawal by the beneficiaries of the State on a daily basis. The procedure for submission of capability by each generating plants and submission of drawal schedule by each beneficiary of the State is intended to enable SLDC to prepare the generation and drawal schedule. This section also deals with methodology for issuing real time dispatch/ drawal instructions and rescheduling, if required, along with the commercial arrangement for the deviations from schedules.

These guidelines are applicable to SLDC, State sector generation companies, generating plants, CGPs , central sector generating plants located in the State, STU, transmission entities in the State. For drawal of power from central sector generation and for transfer to inter-state grid and open access customers the SLDC shall also follow IEGC and coordinate with WRLDC.

6.2 **Demarcation of Responsibilities:**

(i) The SLDC shall have the total responsibility for:

- Scheduling/ dispatching by generating plants including the CGPs;
- Regulating the demand of the beneficiaries in the State;
- Regulating the drawal from the Central generating stations and ;
- Regulating the bilateral interchanges, if any;

(ii) The STU through SLDC shall always endeavour to restrict its net drawal from Central generating stations and other generating plants within their respective drawal schedules.

(iii) The generating plants shall be responsible for power generation generally according to the daily schedule advised to them by the SLDC on the basis of the drawal schedules received from the beneficiaries. However, the generating plants may deviate from the given schedules depending on the plant and system conditions. In particular, they would be allowed / encouraged to generate beyond the given schedule under deficit conditions. Deviations from the ex-bus generation schedules shall be appropriately priced.

Provided that when the frequency is higher than 50.3 Hz, the actual net injection shall not exceed the scheduled dispatch for that hour. Also while the frequency is above 50.3 Hz, the generating plants may (at their discretion) back down without waiting for an advice from SLDC to restrict the frequency rise. When the frequency falls below 50.0 Hz, the generation at all stations (except those on peaking duty) shall be maximized, at least upto the level which can be sustained, without waiting for an advice from SLDC. Notwithstanding the above, the SLDC may direct the generating plants/beneficiaries to increase/decrease their generation/drawal in case of contingencies e.g. overloading of lines / transformers, abnormal voltage, threat to system security. Such directions shall immediately be acted upon.

(iv) For all outages of generation and transmission system, which may have an effect on the State grid, all entities shall cooperate with each other and coordinate their actions as per the procedures finalized separately. In particular, outages requiring restriction of generation which beneficiary can receive (and which may have a commercial implication) shall be planned carefully to achieve the best optimization.

(v) The user(s) shall furnish to the SLDC all requisite information for billing purposes.

(vi) All user(s) shall abide by the concept of frequency-linked load dispatch and pricing of deviations from schedule i.e. unscheduled interchanges. All generating plants of the user(s) and the licensees shall normally be operated according to the standing frequency linked load dispatch guidelines issued by the SLDC to the extent possible, unless otherwise advised by the SLDC.

(vii) The user shall opt to install special energy meters on all inter- connections between the user(s) and other identified points for recording of actual net interchanges and MVARHr drawals. The SLDC shall be responsible for intra-State energy accounting as per the scheme approved by STU and all user(s) shall extend the necessary assistance to the STU personnel in timely collection of metered data.

(viii) Scheduling and dispatch of such CGPs/open access costumers which import and/or export power to the extent of more than 1MW will be subject to scheduling and dispatch by the SLDC.

6.3 Scheduling and Dispatch Procedure:

(i) All the generating stations in the State shall advise the SLDC by 10.00 a.m. every day the station wise ex-bus MW and MWHrs capability foreseen for different hours for the next day i.e. from 00.00 hours to 24.00 hours of the following day. The beneficiaries shall advise by 10.00 a.m. the sub-station wise MW and MWHr requirements foreseen for different hours for the next day i.e., from 00.00 hours to 24.00 hours of following day to the SLDC/SSLDC.

(ii) The SSLDC shall inform the SLDC the MW and MWHr requirements for different hours for the next day by 11.00 a.m. The SLDC will receive information from WRLDC regarding the MW and MW entitlements from Central generating stations for different hours for the next day by 11:00 a.m. The SLDC shall review the foreseen load pattern and the generation capacity available including bilateral exchanges if any, and advise the WRLDC by 3.00 p.m. their drawal schedule for the next day for each of the generating stations in which they have shares and the other generating companies in the State, about their dispatch schedule. The SLDC shall also advise the SSLDCs' their drawal schedule for the next day. The SSLDC, in turn, shall inform the various beneficiaries the MW and MWHr schedules for the next day by 5.00 p.m.

(iii) While finalizing the above daily generation schedules for the generating stations, the SLDC shall ensure that the same are operationally reasonable, particularly in terms of ramping-up / ramping –down rates and the ratio between minimum and maximum generation levels. Additional charges payable to the generating companies on account of such plant operations requiring oil support and / or unit shutdown/start-up shall also be considered by SLDC.

(iv) The generating companies in the State may inform any modification/changes to be made in station wise drawal, schedule / foreseen capabilities, if any, to SLDC by 10.00 p.m.

(v) Based on the surplus, if any, the SLDC may arrange for bilateral exchanges. Such arrangement shall be intimated to WRLDC by the SLDC by 10.00 p.m.

(iv) The SLDC shall receive the final 'drawal schedule' against Central allocation along with bilateral exchange of power, if any by 11.00 p.m.

(v) The SLDC shall inform the final drawal schedule for the next day to SSLDC by 11.15 p.m.

(vi) The SSLDC shall, in turn, inform the beneficiaries the drawal schedule for the next day by 11.30 p.m.

(vii) In the event of any contingency, during the course of the day of operation, WRLDC or any generating station may revise its dispatch schedule and its foreseen capability for the balance period of the day. The SLDC shall then revise the concerned 'drawal schedule' and 'dispatch schedule' in consultation with the concerned beneficiaries and issue the same. All such revisions shall be effective one hour after the first advice is received by the SLDC.

(viii) While finalizing the drawal and dispatch schedules as above, the SLDC and SSLDCs shall also check that the resulting power flows do not give rise to any transmission constraint. In case any impermissible constraints are foreseen, the SLDC shall moderate the schedules to the required extent, under intimation to the concerned users.

(ix) On completion of the operating day, by 24.00 hours, the schedule finally implemented during the day (taking into account all before the fact changes in dispatch schedule of generating stations and drawal schedule of the users shall be issued by SLDC. This schedule shall be the datum for commercial accounting. The average ex-bus capability for each of the generating stations shall also be worked out based on all before-the-fact advice to SLDC.

(x) The SLDC and the SSLDCs shall properly document all the above information i.e. station-wise foreseen ex-power plant capabilities advised by the generating stations, the drawal schedule indented by the beneficiaries, all schedules issued by the SLDC/ SSLDCs, and all revisions/updating of the above.

(xi) SLDC shall be monitor and maintain a record of deviation from the generation schedule. The applicable rates shall be paid by the user(s) to the concerned as per the open access regulations issued by the Commission or as per the terms and condition of the PPA as the case may be.

6.4 Reactive Power And Voltage Control:

(i) Regarding VAR drawal/absorption from the State grid, the SLDC has to follow IEGC. The VAR consumption below 97% voltage and VAR injection above 103% of the rated voltage shall be avoided.

(ii) All the distribution licensees, transmission licensees and STU are expected to provide local VAR compensation such that they do not draw VARs from the EHV grid. VAR compensation has to commence in the following order.

- Consumer end
- Distribution transformer end.
- At the substations end of 11/33KV distribution feeders
- Sub-stations
- Generating stations

(iii) While tap changing on all 400/220 KV ICTs of CTU shall be done as per the instruction of WRLDC, tap changing of other ICTs shall be done as per the instructions of SLDC and SSLDCs.

(ix) The generating stations shall generate/absorb reactive power as per instructions of SLDC, within the capability limits of the respective generating units. No payments shall be made to the generating companies for such VAR generation/absorption.

(x) VAR compensation shall be applied so as to maintain EHV bus power factor 0.98.

(xi) SLDC shall monitor and regulate the VAR requirement of the state grid and direct the connected generating plants generate/absorb reactive power accordingly. Any drawal /injection of VAR beyond the prescribed limits shall be liable for payment of VAR/ Reactive energy charges as prescribed by the Commission time to time.

6.5 Non-compliance of Operational Issues

In case of a non compliance of any of the this code by any user(s) the matter shall be reported by the SLDC to the STU. The STU shall verify and take up the action with the defaulting user(s) for compliance. If user not complained the same then STU may order to disconnect the defaulting user(s) from the grid.

6.5 Non-Payment of Dues

In case of non-payment of capacity and energy charges, unscheduled interchange charges, transmission/SLDC charges, etc. by any user(s), the affected user(s) shall report the matter to the STU. The matter shall be verified and STU shall take up with the defaulting user(s) by STU for paying up the dues. If dues are not paid then STU may order to disconnect the defaulting user(s) from the grid.

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CHAPTER : 7

PROTECTION CODE

7.1 General Principles

Protection standards are treated as interface issues because of the possible severe inter-user boundary repercussions of faults that occur in the system of any entity. Minimum protection requirements are prescribed in this section because inadequate protection or mal-operation of protection system of any entity may result in far reaching consequences, disturbances and even damages in the systems of other entities.

No item of electrical equipment shall be allowed to remain connected to the State transmission system unless it is covered by minimum specified protection aimed at reliability, selectivity, speed and sensitivity.

All users need to co-operate to ensure correct and appropriate settings of protection to achieve effective, discriminatory removal of faulty equipment within the time for target clearance specified in this section.

Protection settings shall not be altered, or protection bypassed and/or disconnected without consultation and agreement of all affected users. In the case where protection is bypassed and/or disconnected, by agreement, then the cause must be rectified and the protection restored to normal condition as quickly as possible. If agreement has not been reached, the electrical equipment will be removed from service forthwith.

7.2 WRLDC shall advice STU regarding:

(i) Planning for upgrading and strengthening protection system based on analysis of grid disturbance and partial/total blackout in State transmission system.

(ii) Planning of islanding and system split schemes and installation of under frequency relays and df/dt relays.

(iii) Installation of under-frequency relay for load shedding, relays provided for islanding scheme, disturbance recorder and fault locator installed at various sub-stations shall be tested and calibrated. The protection practices and Protocol Manual shall have provision for the same.

7.3 Protection Co-ordination

Users shall take prompt action to correct any protection malfunction or issue as discussed and agreed to in these periodical meetings-

7.4 Fault Clearance Times & Short-Time Ratings

From a stability consideration, the minimum short circuit current rating and time and the maximum fault clearance times for faults on any user's system directly connected to the State transmission system; or any faults on the State transmission system itself, are as follows:

Nominal Voltage	Minimum Short Circuit current rating and duration of Switchgear		Target Fault clearance Time by primary protection
KV	kA (rms)	Second(s)	m.sec.
400kV	40	1	60
220kV	31/40	1	140
132kV	25/31	3	140

Slower fault clearance times for faults on a user's system may be agreed to but only if, in STU's opinion, system conditions allow this. STU shall specify the required opening time and rupturing capacity of the circuit breakers at various locations for STU and Discoms/ open access customers directly connected to transmission system. At generating stations, line faults should be cleared at the generation station end, within the critical clearing time, for the generators to remain in synchronism.

7.5 Generator Requirements

The guidelines mentioned in the "Manual on protection of Generators, Generator Transformers, and 220 kV and 400 kV networks" vide publication no 274 of CBIP shall be kept in view.

All generating units and all associated electrical equipment of the generating units connected to the State transmission system shall be protected by adequate protection so that the State Transmission System does not suffer due to any disturbances originating from the generation unit. The generator protection schemes shall cover at least differential protection, back up protection, stator earth fault protection, field ground/field failure protection (not applicable to brush-less excitation system), negative sequence protection, under frequency, over flux protection, back-up impedance protection and pole slipping protection (applicable to units above 200MW), loss of field protection, reverse power protection etc.

7.6 Transmission Line Requirements

7.6.1 General

Every EHV line taking off from a Power Station or a sub-station shall have protection and back up protection as mentioned below. STU shall notify users of any changes in its policy on protection from time to time.

For short transmission lines, alternative appropriate protection schemes may be adopted.

Relay panels for the protection of lines of STU taking off from a power generating station, shall be owned and maintained by the generator. Any transmission line related relay settings or any change in relay settings will be carried out by the generator in close co-ordination and consultation with STU and with the latters approval. Carrier cabinets / equipment, line matching units including wave traps and communication cable shall be owned and maintained by STU. All generators shall provide space, connection facility, and access to STU for such purpose.

7.6.2 400kV transmission lines

All 400kV transmission lines owned by STU shall have two fast acting protection schemes, the voltage of the two relays shall be fed from two different cores of the line CVT and the currents of the two relays shall be fed from two different cores of the line CTs. Main 1 protection scheme shall be numerical, three zone, non-switched fast acting distance protection scheme with permissible inter-trip at remote end (in case of zone-2 fault)

Main 2 protection scheme shall be either similar type of numerical, three zone, non-switched fast acting distance protection scheme with permissible inter-trip at remote end (in case of zone-2 fault) OR a unit protection scheme employing transient wave detection, directional comparison or phase comparison carrier relaying scheme.

One pole tripping and single shot auto-reclosing with adjustable dead-time shall be provided.

Over voltage relay for steady state and transient over voltage rise will have to be installed.

400kV and 220kV system will invariably be provided with breaker back up protections.

400kV line /220 kV lines protection will have inter trip arrangement through carrier so that tripping at one end of line is transmitted to other end also.

7.6.3 **400kV Bus-bars**

All 400kV sub-station shall have bus bus-bar differential protection scheme along with LBB and auto-reclosures for transmission lines.

7.6.4 **220kV transmission lines**

All 220kV transmission lines owned by STU shall have single, numerical, three zone, nonswitched fast acting distance protection scheme, preferably with permissible inter-trip feature at remote end (in case of zone-2 fault), single pole tripping and single-shot single pole autoreclosing with adjustable dead-time shall be provided.

For back-up protection, three directional IDMT over current relays and one directional earth fault relay shall be provided.

For short transmission lines, appropriate alternative protection schemes may be adopted.

7.6.5 **220kV Bus-bars**

Identified important 220kV sub-station (e.g. having generation infeed, PGCIL interfacing substation etc.) shall have bus bus-bar differential protection scheme along with LBB and autoreclosures for transmission lines.

7.6.6 **132kV Lines**

A single three zone, switched/non-switched static distance protection scheme shall be provided as main protection. The backup protection shall be at least two directional IDMTL over current relays and one directional earth fault relay.
For short transmission line, appropriate alternative protection schemes may be adopted.

7.7 Transformer Requirements

1 The protection of Auto Transformers, Power Transformers and Distribution Transformers shall be as per revised manual on transformers published by Central Board of Irrigation and Power (CBIP) Publication No. 275.

2 All windings of Auto Transformers and power transformer of EHT class shall be protected by differential relays having percent bias and harmonic restraint features.

3 Over-fluxing relays shall be provided for EHT transformers.

4 All 400kV class transformers shall have Restricted Earth Fault (REF) protection for winding.

5 In addition, there shall be back up Inverse definite minimum time (IDMT) over current and earth fault protection.

6 For parallel operation, such back up protection shall have directional feature. For protection against heavy short circuits, the over current relays should incorporate a high set instantaneous element, wherever overall co-ordination permits the same. However, it should not rip due to inrush of the magnetising current and should not be set to such a high value, which is not beneficial to transformer.

7 In addition to electrical protection, gas operated relays, winding temperature protection and oil temperature protection shall be provided.

8 It is recommended that the following minimum protections should be provided for transformers:

(a) All 400kV class power transformers shall be provided with differential, REF, open delta (Neutral Displacement Relay) and over-fluxing relays. In addition, there shall be back up IDMT over current and earth fault protection. For parallel operation, such back up protection shall have inter-tripping of both HT

and LT breakers. For protection against heavy short circuits, the over current relays should incorporate a high set instantaneous element. In addition to electrical protection, transformer own protection viz. buchholz, over load tap changer (OLTC) oil surge, gas operated relays, winding temperature protection, oil temperature protection, Pressure realize valve (PRV) device shall be provided for alarm and trip functions. It is recommended to have Double PRV protection scheme for transformer tank.

(b) All 220kV class power transformers shall have same protections as mentioned in Sections as mentioned in 8.8.8 (a) except REF protection.

9. Delta tertiary winding of ICT if used for loading purpose shall be adequately protected by a Lighting Arrestor , surge capacitor and neutral displacement relay (NDR) protection connecting as open delta winding of PT.

7.8 Sub-station Fire Protection

Adequate precautions shall be taken and protection shall be provided against fire hazards to all apparatus of the users conforming to relevant Indian Standard Specification and /or provisions in I.E. Rules.

7.9 Calibration & Testing

The protection scheme shall be tested at each 400kV, 220kV, 132kV sub-station by STU once in a year or immediately after any major fault, which ever is earlier. Setting, co-ordination, testing and calibration of all protection schemes pertaining to generating units/stations shall be responsibility of CSEB.

7.10 Data Requirements

Users shall provide STU with data for this section as specified in the Data Registration section.

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CHAPTER : 8

TRANSMISSION METERING CODE

8.1 General Principles

8.1.1 The scope of this part of the grid code covers the practices that shall be employed and the facilities that shall be provided for the measurement and recording of various parameters of electricity transmission like active/reactive/ apparent power/energy, power factor, voltage, frequency etc.

8.1.2 This Code sets out or refers to the requirements of metering at generating stations, sub-stations and interfaces for check meter, consumer meter (tariff meter), correct meter and energy accounting and audit meter, interface meter and main meter as specified in the CEA (Installation and Operation of Meter) Regulations, 2006.

8.1.3 This Code also specifies the requirement for calibration, testing and commissioning of metering equipments viz. energy meters with associated accessories, current transformers and voltage transformers. The code broadly indicates the technical features of various elements of the metering, data communication, testing and calibration system, the procedure for assessment of consumption in case of defective and stuck-up meters and also lays down guidelines for resolution of disputes between different agencies.

8.1.4 The generating plants supplying power to the open access consumer, will be required to do the metering as per ABT scheme and ABT meters will be installed both ends i.e. injection point and drawal point .

8.1.5 Open access customers/consumers shall have to provide software for billing to licensee and for operation to SLDC with communication facility for transfer of real time data through v-set or through lease line.

8.2 Reference Standards

8.2.1 The following Indian Standards (as amended to date) shall be applicable as relevant to meters and associated equipment:-

S.No.	Standard Number	Standard Title
	IS 13779	AC Static Watt-hour Meters for Class 1 and 2
i	IS 14697	AC Static Transformer Operated Watt-hour and VAr-hour Meters, Class 0.2S and 0.5S
	IS 2705	Indian Standard for Current Transformers
	IS 3156	Indian Standard for Voltage Transformers
	IS 9348	Indian Standard for Coupling Capacitors and Capacitor Divider
	IS 5547	Indian Standard for Capacitor Voltage Transformer
i.	CBIP Technical Report - 88	Specification for AC Static Electrical Energy Meters
ii.	CBIP Technical Report - 111	Specification for Common Meter Reading Instrument

iii.	IS 9000	Basic Environmental Testing Procedures for Electronic & Electrical items
iv	IS 12063	Indian Standard for classification of degrees of protection

8.2.2 The following International Standards (as amended to date) can be applicable as relevant to meters and associated equipment not complying to Indian Standards or not manufactured in India:

S. No.	Standard Number	Standard Title
i.	IEC 687	Specification for AC Static Watt-hour Meters for Active Energy (Classes 0.2S and 0.5S)
ii.	IEC 1036	Alternating Current Static Watt-hour Meters for Active Energy (Classes 1 and 2)
iii	IEC 1268	Alternating Current Static Watt-hour Meters for Reactive Energy (Classes 2 and 3)

8.3 Ownership

The ownership of the metering system shall of the procurer and provider of the meters and the custodian will be the respective user(s).

8.4 Facility to be Provided on Metering Locations

The user(s) shall make available the required space and the required outputs of the specified current and voltage transformers to facilitate installation of meters and associated equipment and shall carry out operation and maintenance of these equipments. Necessary auxiliary supply shall be extended up to the metering system, if meter is powered by only external supply.

8.5 Application of metering system

8.5.1 **Generating plants and Open Access Customer:**

For existing all non conventional sources biased Generating plants(NCE), Generating plants and Open Access Customer shall purchase and provide ABT metering system and software within two month from the issue of this Code, in absence of ABT meter permission for open access shall we withdrawn. It is also compulsory for Open Access Customer those who are receiving power from NCE.

In case of generating plants/Open Access Customer availing/seeking open access, the metering equipments shall be installed on incoming/outgoing feeders of grid substation from the power to be injected or drawn.

In case of any distribution licensee availing/seeking open access, metering equipment shall be installed at each supply points interfacing with transmission network.

8.5.2 The check meters shall be installed on each generator terminal, HV side of generator step-up transformer (GST), LV side of unit auxiliary transformer (UAT), HV side of Station Transformers (ST) and all outgoing feeders at generating plants to work out energy generated and energy delivered by the power station in the grid. Commercial settlement shall be based on the energy meters installed at interface points as defined in this code or applicable PPA.

8.5.3 **Metering between State transmission utility -distribution licensee:**

(a) For measurement of power delivered by State transmission utility to distribution licensee (excluding station transformer consumption), metering shall be provided on the LV side of EHV Power Transformer i.e. 33kV side of 132/33kV and 11kV side of 132/11kV transformers installed in EHV sub-stations.

Operational meters shall also be provided on all outgoing 33kV and 11kV feeders for energy audit on feeder and reconciliation of energy with respect to energy measured on LV side of EHV power transformer.

(b) In case of EHV industrial and railway traction consumers of distribution licensee directly fed from 220kV or 132kV sub-station of State transmission utility, tariff metering shall be provided on outgoing feeder emanating from EHV sub-station of State transmission utility.

8.5.4 **Sub-station Auxiliary Consumption Metering:**

The State transmission utility sub-stations auxiliary consumption shall be recorded on LV side of station auxiliary transformers. If such transformer(s) is feeding other local load (colony quarters, street lights etc.) apart from sub-station auxiliary load, separate metering shall be provided on individual feeders.

Except unidirectional kWh, other data logging/billing capabilities/energy registers/other features may not be required for this application.

8.5.5 **Operational Metering:**

Operational metering shall be sited wherever reasonably required by State transmission utility /generating companies for applications other than tariff metering. The parameters and other requirements shall be finalized by State transmission utility based on the operational requirements.

8.6 Operation and Maintenance of the Metering System

The maintenance of the meters shall be the exclusive responsibility of the owner/licensee of the meters. The operation and maintenance of the metering system includes proper installation, regular maintenance of the metering system, checking of errors of the CTs, VTs and meters, proper laying of cables and protection thereof; cleaning of connections/joints, checking of voltage drop in the CT/ VT leads, condition of meter box and enclosure, condition of seals, regular/daily reading meters and regular data retrieved through common metering reading instrument (CMRI) and data processing system (DPS), attending any breakdown/fault on the metering system etc.

8.7 Minimum technical requirements for energy meter

8.7.1 Measuring Elements: The meter shall be 3 phase 4 wire, full four quadrant type static Tri-vector Meter (TVM), which can be used for 3 phase 3 wire system or 2 phase 2 wire system (traction application) without affecting the metering accuracy and other essential parameters.

8.7.2 Meter shall basically In case of import and export power requirement of different degree by the captive power generators/ consumers through the same connectivity /line, it will be ensured that the ratio between the two i.e. import/export or export/import should be within ratio 1:20.

8.7.3 In case where import/export or export/import ratio lies within 1:20, the metering will be arranged through meters and CTs having class 0.5S accuracy class and metering core of CTs with 5 Amp secondary rating. The minimum limit of import and export would be 1MW on either side i.e. import or export side.

8.7.4 The ABT meter shall have facility to correct the ratio error and phase angle error of external CTs and VTs connected to it.

8.7.5 To measure fundamental rms value of electricity and harmonics.

8.7.6 Operating System Parameters (for balanced and unbalanced load):

(a) Operating Voltage Range: The meter shall work satisfactorily on 110 Volts AC (Line-Line) or 415 Volts AC (Line-Line) with variation range of -30% to + 15%.

(b) Operating Frequency Range: The meter shall work satisfactorily on 50 Hertz with variation range of -5% to +5%.

(c) Operating Power Factor Range: The meter shall work satisfactorily over a power factor range of zero lag to unity to zero lead.

8.7.7 Rated Nominal Current and Rated Maximum Current: Meter shall operate on I Ampere or 5 Ampere from CT secondary circuit. Rated maximum secondary current shall not exceed 120% of nominal current.

8.7.8 Rated Short time Current: Meter shall be capable of withstanding 20 times the rated nominal current for 0.5 second.

8.7.9 Minimum Starting Current: The meter shall start operating and recording energy with minimum starting current equal to 0.1 % of nominal current at unity power factor.

8.7.10 Burden and Power Consumption: The burden imposed by the metering system shall not exceed 1 W, 8 VA for voltage circuit and 1 VA for current circuit so that there is no significant voltage drop in the VT and CT leads.

8.7.11 Accuracy Class (Better than the mentioned accuracy class shall be acceptable):

	Particular	**Parameter**	**Main Meter**	**Check Meter**	**Sub-station Auxiliary Meter**
I.	Tariff Meter	Active Energy Reactive Energy	0.2S 0.5S	0.2S 0.5S	1.0 2.0
II.	Operational Meter	Active Energy Reactive Energy	0.5/1.0 1.0/2.0	0.5/1.0 1.0/2.0	- -

8.7.12 **Earthing System**: The metering system shall be suitable for solidly earthed power system.

8.7.13 **Meter Box:** The meter box shall confirm to the degree of protection not less than IP-51 as stipulated in IS 12063, and shall be capable of satisfactory operation in an indoor, non-air conditioned installation.

8.7.14 **Installation and mounting:**

The meter shall be suitable for install indoor or outdoor application. The meter can be mounted in dust proof, lockable and tamper proof panel or rack or metal box, as per requirement and site condition, conforming to minimum IP-31 standereds.

The metering system shall have facility of CT shorting when the meter module is withdrawn or dismantled.

8.7.15 **Data Display Capabilities** - Instantaneous Values:

The meter shall be capable to record and display (on demand) at least the following instantaneous parameters/information:

(a) Three rms line voltages

(b) Three rms line currents

(c) System frequency (Hz)

(d) Power factor with sign of lag/lead.

(e) Watt - Import

(f) Watt - Export

(g) VAr - Lead

(h) VAr - Lag

(i) VA - Import

(j) VA - Export

(k) Maximum Demand (Import) during the month in Watt and VA with date and time

(l) Maximum Demand (Export) during the month in Watt and VA with date and time

(m) Meter Serial Number

8.7.16 **Data Storage Capabilities** - Cumulative Values:

The meter shall be capable to record, store and display (on demand) at least following cumulative parameters. At least five (5) registers shall be provided for each parameter, out of which one (1) register shall record energy for 24 hours in a day whereas other four (4) registers shall record Time of Day (TOD) energy during morning peak, morning offpeak, evening peak and evening off-peak durations:

(a) Watt hour - Import

(b) Watt hour - Export

(c) VAr hour - Lead while Watt hour - Import

(d) VAr hour - Lag while Watt hour - Import

(e) VAr hour - Lead while Watt hour - Export

(f) VAr hour - Lag while Watt hour - Export

(g) VA hour - Import

(h) VA hour - Export

(i) VAr hour during low voltage (V<97%)*

(j) VAr hour during high voltage (V>103%)*

**These parameters are for Availability Based Tariff (ABT) purpose only hence TOD registers are not required*

8.7.17 **Data Logging Capabilities 1** - Integrated Values:

The meter shall have sufficient memory to store any combination of at least ten (10) parameters listed in Clause 0 and Clause 0 over minimum forty (40) days at a logging interval of fifteen (15) minutes. The State transmission utility shall be able to select these parameters locally through optical port using CMRI and/or remotely through communication port. At least, following essential parameters shall be logged at an interval of 15 minutes:

(a) Watt - Import

(b) Watt - Export

(c) VAr - Lead while Watt - Import

(d) VAr - Lag while Watt - Import

(e) VAr - Lead while Watt - Export

(f) VAr - Lag while Watt - Export

(g) VAr hour during low voltage (V<97%)

(h) VAr hour during high voltage (V>103%)

(i) Average frequency (Hz)

(j) Average three phase voltage

In case of operational metering, the number of parameters and their logging intervals shall be decided by the Licensee as per their operational requirements.

8.7.18 **Other Parameters:**
Each meter shall also store the values of active energy (Import), active energy (Export), reactive energy (lag) and reactive energy (lead) separately during active energy (import) & active energy (export) conditions recorded at 24:00 hours on last day of the month for a period of at least twelve (12) months. user shall be able to program time and day at which value of energy to be stored in the memory.

8.7.19 **Events and Abnormalities Logging Capabilities:**

The meter shall be able to log date and time stamped events captured with a resolution of at least one (1) second. Sufficient memory shall be provided to store at least last 100 events in the meter on First-In-First-Out (FIFO) basis with compartment wise as following, but not limited to:

(a) Missing potential (VT supply missing)
(b) CT/VT Polarity reversal
(c) Current unbalances (magnitude as well as phase unbalance) in any one of the phases or more than one phase
(d) Voltage unbalances (magnitude as well as phase unbalance) in any one of the phases or more than one phase
(e) Supply interruptions along with the duration of each interruption
(f) Tamper information/anomaly occurrence/anomaly restoration.
(g) Meter internal set-up/program change information

8.7.20 **Real Time Clock (RTC) and Calender:**

The meter shall have in-built Quartz crystal based accurate Real Time Clock. The meter shall display real time in 24 hours format (hh: mm: ss).

Meter shall also display the date as per Indian calendar in dd-mm-yyyy format. Thirty (30) years calendar with automatic leap year adjustment shall be provided in the meter.

The accuracy of the clock and calendar shall be better than one minute per year.

8.7.21 **Time synchronization:**

All meters shall have facility for time synchronisation locally and/or remotely through a Global Positioning System (GPS) or through the central computer (at CDCC) using the same port used for remote data communication.

8.7.22 **Data retention:**

The logged data shall be stored in a non-volatile memory of meter with a minimum retention period of ten (10) years without any battery back-up.

8.7.23 **Data concentration and network integration:**

The local network of all meters installed in a sub-station shall be formed using modem/ multiplexer/data concentrator/LAN hub switch. This local network shall be integrated with communication network using appropriate standard protocol.

Communication network may be based on Radio frequency, Microwave, Public Switched Telephone Network (PSTN), Power Line Carrier Communication (PLCC), Vary Small Aperture Terminal (VSAT) network, Optical Fibre Cable (OFC), GSM, Radio or any other means of telemetry.

8.7.24 **Pulse Output:**

High intensity light emitting diodes (LED) shall be provided on front of the meter for test calibration and accuracy check of Wh and VArh measurements.

8.7.25 **Display:**

Meter shall have a minimum of 7 digits Alpha-numeric liquid crystal display (LCD) or light emitting diode (LED) type display with bright back-light and automatic back-light time out feature. A touch key pad or push buttons shall be provided on the meter front for switching ON the display and for changing from one indication to next. Two separate push buttons shall be provided one for scrolling and other for MD resetting.

8.7.26 **Data Security:**

(a) Data encryption (coding) capability

(b) Mechanical seals and locks i.e. sealing provision for terminal block, meter cover, MD reset predefined date and time or CMRI and all communication ports.

(c) Message authentication algorithm capability/Multi-level password protection

(d) Independent security across communication channels

8.7.27 **Self-Diagnostics feature:**

The meter shall have self diagnostics feature to scan the healthiness of internal components and circuitry. On detection of any exception or fault, meter shall display the message immediately.

8.7.28 **Communication Ports:**

The meter shall have at least following communication ports:

(a) One optically isolated infra-red communication port (optical port) for local communication as per IEC 1107

(b) One galvanically isolated Ethernet (LAN) port or RS485 serial port or RS232 serial port for remote communication

8.7.29 **Communication Protocol:**

For communication by meter with external devices, meter supplier shall implement industry standard open protocol(s) like MODBUS RTU, MODBUS, TCP/IP, IEC 870-5-102, IEEE 1377, DNP 3.0, Device Language Message Specification (DLMS) or any other industry standard protocol.

In case of proprietary protocol, the meter supplier shall furnish the protocol software and details of protocol followed by him. Any variation in the standard protocol for optimizing communication resources shall be detailed.

8.7.30 **Reprogramming of the meter:**

Utility shall be able to select the display parameters, logging parameters, timings of TOD registers, billing dates, logging interval or any other parameter locally using CMRI through optical and/or remotely using meter reprogramming software installed at CDCC through communication port(s).

8.7.31 **Data Downloading:**

Utility shall be able to download the logged data locally using CMRI through optical port and/or remotely using meter interrogation software installed at CDCC through communication port(s). Any interrogation/read operation shall not delete or alter any stored meter data.

8.7.32 **External auxiliary supply:**

The metering system shall derive operating system from AC or DC auxiliary supply and shall not load measurement PT's for their operation. The metering system shall automatically switch between the AC/DC auxiliary supplies based on its availability. The standard auxiliary voltage shall be 110V or 240V AC and 110V or 240V DC.The voltage regulation in the auxiliary supply shall be within ± 10%.

8.8 Minimum technical requirement for instrumentation transformer :

8.8.1 Single-phase type current transformers shall be used for 3 phase 4 wire and 3 phase 3 wire or 2 phase 2 wire system (traction application) measurement system. The secondary current rating of the current transformer(CT) shall be 1 ampere or 5 ampere depending upon the total circuit burden. 5A secondary can be used for low burden circuits.

8.8.2 Either dedicated set of CT/VT or dedicated core of current transformers shall be provided for metering and wherever feasible, CTs (or their cores) feeding to main meters and check meters shall be separate. The errors of the CT/VT shall be checked in the laboratory or at site. The errors of the CT/VTs shall be tested using National accredited mobile Laboratory (NABL) or at any accredited laboratory and recalibrated if required at manufacturer's works.

8.8.3 The total burden connected to each current transformer shall not exceed the rated burden of CT/VT. Total circuit burden shall be kept close to rated burden of CT for minimum error and percentage voltage drop in VT leads shall be within the permissible limits.

8.8.4 Either Electromagnetic Voltage Transformers (EVT) or Capacitive Voltage transformer (CVT) may be used for metering purpose. Generally, voltage transformers (VT) is used to cover either EVT or CVT. The secondary voltage per phase shall be 110/√3 volts or 415/√3 volts. Fuses of proper rating shall be provided at appropriate locations in the VT circuit.

8.8.5 The minimum acceptable detailed specification for instrumentation transformer are as follows.

A) Minimum acceptable specifications of dedicated single-phase EHV & HV current transformers (CT) for metering

S. No.	Particulars	11KV	33KV	132KV	220KV
1	Nominal System Voltage (Kv rms)	11	33	132	220
2	Highest System Voltage (kV rms)	12	36	145	245
3	Reference Standard	IS 2705 with latest amendments			
4	Standard CT Ratio	2000-1000/1-1	800-400/1-1	800-400/1-1-1	1200-600/1-1-1-1
		1600-800/1-1	600-300/1-1	400-200/1-1-1	800-400/1-1-1-1
		1200-600/1-1	400-200/1-1	200-100/1-1-1	
		800-400/1-1	300-150/1-1	100-50/1-1-1	
		600-300/1-1	100-50/1-1		
		400-200/1-1			
		300-150/1-1			
		150-75/1-1			
5.	No. of Metering cores	Two			
6.	Rated Continuous Thermal Current	120% of Rated Primary Current			
7.	Rated Short time thermal primary current	13.1 KA for 1 sec	26.2 KA for 2 sec	40 KA for 1 sec	40 KA for 1 sec
8.:	CT characteristics				
(a)	Rated Primary Current (Amps)	2000-1000	800-400	400	800
		1600-800	600-300	200	
		1200-600	400-200	100	
		800-400	300-150	50	
		600-300	100-50		
		400-200			
		300-150			
		150-75			
(b)	Rated Secondary Current (Amps)	1 or 5	1 or 5	1 or 5	1 or 5
(c)	Accuracy Class	0.2	0.2	0.2	0.2
(d)	Maximum Instrument Security Factor (ISF)	5	5	5	5
(e)	Rated Secondary Burden (VA)	30	30	30	40
9.	Reference Standard for insulating oil	IS 335 with latest amendments			

B) Minimum acceptable specifications of dedicated three-phase HV CT-PT set for metering

S.No.	Particulars	33kV
	Specification of CT (for CT-PT Set)	
1	Nominal System Voltage (kV rms)	33
2	Highest System Voltage (kV rms)	36
3	Reference Standard	IS 3156 with latest amendments
	Standard CT Ratio (Amps/Amps)	200-100/1-1 100-50/1-1
	Rated continuous thermal current	120% of rated primary current
	Rated short time thermal primary current for 1 second (in kA)	25
7.	CT Characteristic:	
a	Rated Primary Current (Amps)	200-100 100-50
b	Rated Secondary Current (Amps)	1
c	Accuracy Class	0.2
d	Maximum Instrument Security Factor (ISF)	<10
e	Rated Secondary Burden (VA)	30
8.	Reference Standard for insulating oil	IS 335 with latest amendments
	Specification of PT (for CT-PT Set)	
1	Nominal System Voltage (kV rms)	33
2	Highest System Voltage (kV rms)	36
3	Reference Standard	IS 3156 with latest amendments
	No. of Secondary Windings for potential measurement devices	Two
	Standard Voltage Ratio	33kV/√3 / 110V/√3
	Rated Secondary Burden (VA) per winding	50
	Accuracy Class (At 10% to 100% of rated VA burden)	0.2
	Rated Voltage Factor and Duration	1.2 continuous and 1.5 for 30 seconds

C) Minimum acceptable specifications of dedicated single-phase EHV capacitor voltage transformers (CVT) for metering

Sr. No.	Particulars	132kV	220kV
1	Nominal System Voltage (kV rms)	132	220
2	Highest System Voltage (kV rms)	145	245
3	Reference Standard	IS 3156 with latest amendments	
4	Rated Capacitance (pF)	4400 pF with tolerance +10% and -5%	
5	For low voltage terminal over entire carrier frequency		
	(a) Stray Capacitance	Shall not exceed 200 pF	
	(b) Stray Conductance	Shall not exceed 20 micro siemens	
6	(a) High frequency capacitance for entire carrier frequency range	Within 80% to 150% of rated capacitance	
	(b) Equivalent Series Resistance over the entire frequency range	Less than 40 ohms	
7	No. of Secondary Windings for potential measurement devices	Two	Two

8	Standard Voltage Ratio		
	(a) Winding-I	132kV/√3 / 110V/√3	220kV/√3 / 110V/√3
	(b) Winding-II	132kV/√3 / 110V/√3	220kV/√3 / 110V/√3
9	Rated Secondary Burden (VA)		
	(a) Winding-I	50	50
	(b) Winding-II	50	50
10	Accuracy Class		
	(a) Winding-I	0.2	
	(b) Winding-II	0.2	
11	Rated Voltage Factor and Duration		
	(a) Winding-I	1.2 continuous and 1.5 for 30 seconds	
	(b) Winding-II	1.2 continuous and 1.5 for 30 seconds	
12	Reference Standard for insulating oil	IS 335 with latest amendments	

NOTE: Electromagnetic VTs may be used up to 220KV class.

D) Minimum acceptable specifications of dedicated single-phase EHV potential transformers (PT) for metering

S. No.	Particulars	132kV	220kV
1	Nominal System Voltage (kV rms)	132	220
2	Highest System Voltage (kV rms)	145	245
3	Reference Standard	IS 3156 with latest amendments	
4	No. of Secondary Windings for potential measurement devices	**Two**	**Two**
5	Standard Voltage Ratio		
	(a) Winding-I	132kV/√3 / 110V/√3	220kV/√3 / 110V/√3
	(b) Winding-II	132kV/√3 / 110V/√3	220kV/√3 / 110V/√3
6	Rated Secondary Burden (VA)		
	(a)Winding-I	200	200
	(b) Winding-II	50	50
	(c) Winding-III	50	50
7	Accuracy Class		
	(a) Winding-I	3 P	
	(b) Winding-II	0.2	
	(c) Winding-III	0.2	
8	Rated Voltage Factor and Duration		
	(a) Winding-I	1.2 continuous and 1.5 for 30 seconds	
	(b) Winding-II	1.2 continuous and 1.5 for 30 seconds	
9	Reference Standard for insulating oil	IS 335 with latest amendments	

E) Minimum acceptable specifications of dedicated single-phase HV potential transformers (PT) for metering

S.No.	Particulars	33kV	11kV
1	Nominal System Voltage (kV rms)	33	11
2	Highest System Voltage (kV rms)	36	12
3	Reference Standard	IS 3156 with latest amendments	
4	No. of Secondary Windings for potential measurement devices	**Two**	**Two**

5	Standard Voltage Ratio	33kV/√3 / 110V/√3	11kV/√3 / 110V/√3
6	Rated Secondary Burden (VA) per winding	100	100
	(a)Winding-I	100	100
	(b) Winding-II	50	50
	(c) Winding-III	50	50
7	Accuracy Class(At 10% to 100% of rated VA burden)	0.2	0.2
	(a) Winding-I	3 P	
	(b) Winding-II	0.2	
	(c) Winding-III	0.2	
8	Rated Voltage Factor and Duration	1.2 continuous and 1.5 for 30 seconds	

8.9 **Testing Arrangements**

8.9.1 The test terminal blocks shall be provided on all meters to facilitate testing of meters. Portable test set with high accuracy static source and 5 times more accurate (or better) electronic reference standard meter shall be used for testing. This means at least class 0.5S reference standard meter for testing of class 0.2S meter, class 0.1S reference standard meter for testing of class 0.5S meter and class 0.2S reference meters for testing of class 1.0S meter. These benches shall also be used for checking and calibration of portable testing equipments. The above shall be applicable for laboratory testing of meters, however, for site testing meter testing equipments with one class higher accuracy than meter under test may be used as per provision of IS-12346-1999.

8.9.2 Separate test terminal blocks for testing of main and check meters shall be provided so that when one meter is under testing, the other meter continues to record actual energy during testing period. Where only one/main meter exists, an additional meter shall be put in circuit during the testing period of the main meter so that while the main meter is under testing, the other meter can record energy during the period of meter under testing.

8.10 System for joint inspection, testing, calibration

8.10.1 The metering system located at metering points between generating plants, State transmission utility and distribution licensees shall be regularly inspected, tested and calibrated at least once in a year (or at an interval lesser than one year as mutually agreed) jointly by both the agencies involved for dispatch and receipt of energy. Since the static trivector meters are calibrated through software at the manufacturers' works, only accuracy of the meters and functioning shall be verified during joint inspection. In case of any doubt or defect, the meter shall be replaced then and there or calibrated. In later case, error correction as determined will be applied to the meter reading for the purpose of billing. To cover for loss of time, spare meters shall always be kept available with the agency to whom the meter/metering point belongs. After testing, the meter shall be properly sealed and a joint report shall be prepared giving details of testing work carried out, details of old seals removed and new seals affixed, test results, further action to be taken (if any) etc.

8.10.2 Joint inspection shall also be carried out as and when difference in meter readings (so corrected) exceeds the sum of maximum error as per accuracy class of main and check meter. The meters shall be jointly tested/ calibrated on all loads and power factors as per relevant standards through static phantom load.

8.11 Meter Sealing Provision

8.11.1 Metering systems shall be jointly sealed by the authorized representatives of the concerned parties. The sealing of meter shall be arranged as per the provisions in CEA (Installation and Operation of Meters) Regulation 2006.

8.11.2 The register/record of the issue of seals and sealing pliers, shall keep proper with the authorized persons to whom these are issued.

8.11.3 No seal, applied pursuant to this metering code, shall be broken or removed except in the presence of or with the prior consent of the agency affixing the seal or on whose behalf the seal has been affixed unless it is necessary to do so in circumstances where (i) both main and check meters are malfunctioning or there occurs a fire or similar hazard and such removal is essential and such consent can not be obtained immediately (ii) such action is required for the purpose of attending to the meter failure. In such circumstances, verbal consent shall be given immediately and it must be confirmed in writing forthwith.

8.11.4 Sealing of the metering system shall be carried out in such a manner so as not to hamper downloading of the data from the meter using CMRI or a remote meter reading system.

8.12 Procedure for Assessment of Consumption In Case of Defective and/or Stuck-Up Meter

8.12.1 Whenever a meter goes defective, the consumption recorded by the check meter shall be referred to for a period agreed mutually between the user and the STU. The details of the malfunctioning along with date, time and snap-shot parameters along with load survey shall be retrieved from the main meter. The exact nature of mal-functioning shall be brought out after analyzing the data so retrieved and the consumption/losses recorded by the main meter shall be assessed accordingly.

8.12.2 If the main as well as check metering systems become defective, the assessment of energy consumption for the outage not more than week period shall be done by the STU on basis of record of substation where the injection or drawal take palace. If both the meters remain defective for more than one week then the grid connectivity shall be discontinued.

8.13 Replacement of defective or stuck-up meter

A defective or stuck-up meter shall be replaced as soon as possible. The owner of the meter shall maintain spare inventory of meters, so that down time is minimized.

8.14 Mechanism for dispute resolution

Any disputes relating to inter-utility metering between State transmission utility and any generating company/distribution licensees/users shall be settled in accordance with procedures given under relevant power purchase agreements (PPA)/connection agreement or relevant agreement, as the case may be. In case of unresolved dispute, the matter may be referred to the Commission.

8.15. To keep pace with continuous and fast up-gradation in the technology of metering and communication, the metering code needs to be reviewed periodically as per CEA Regulations/ guidelines and the Commission's directives from time to time.

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CHAPTER : 9

CONTINGENCY PLANNING

9.1 General Principles

9.1.1 To the define the responsibilities of all the users for achieving the fastest possible recovery of the grid in the event of a failure in the transmission system, or any sudden loss of Generation or a blackout caused due to the failure of the Western Grid. The procedure to be adopted for a fast recovery shall take into account the following:

- The possible transfer of power from the neighboring System through Inter State transmission lines,
- The extent of immediate availability of power from the Central Sector generating stations and the generating plants.

9.1.2 The main objective is to achieve the following:

a) The essential loads required to be restored immediately.

b) Restoration of the total system and associated demand in the shortest possible time.

c) Resynchronization of parts of the system which have ceased to be in synchronism,

d) To ensure that the communication arrangements for use in circumstances of serious disruption to the System, are available to enable senior management representatives of the SLDC, the transmission licensee and the users who are authorized to take decisions on behalf of the transmission licensee or the user.

e) To ensure that the transmission system can operate in the event of the SLDC is incapacitated for any reason.

f) The situation prevailing prior to the occurrence of the contingency, e.g. availability of specific generating stations, transmission lines, and load demands will largely determine the restoration procedure to be adopted in the event of a total blackout.

g) The SLDC shall co-ordinate with WRLDC and other State LDCs in determining the extent of problems. The SLDC shall inform maximum users of the situation and advice them to follow the strategy as outlined in this section for restoration.

h) The communication and acceptance of all operational communications throughout the period of contingency. The use of communication channels shall be restricted to the operational communications only, till normalcy is restored.

9.2 Total Regional Blackout:

9.2.1 In case of Total Regional Blackout, the recovery shall be as per the Black Start procedure prepared by WRLDC in consultation with all the constituents of western region. As these procedures are updated periodically, the last updated procedures shall be followed during the total regional blackout.

9.3 Partial state transmission system blackout:

9.3.1 In case of partial State transmission system blackout, the recovery shall be as per the Black Start/Restoration procedure prepared by SLDC in consultation with the users. As these procedures are updated periodically, the last updated procedures shall be followed during the partial state transmission system blackout. The instruction issued by SLDC in restoration of system from partial black out shall be followed by the users even though the same is not specifically mentioned in Black Start procedure/ restoration document.

9.4 Responsibilities:

9.4.1 The SLDC shall maintain a record of Generating plants with black start capabilities and Black Start operation plans.

9.4.2 The STU shall prepare, distribute, and maintain up-to-date 'black start' procedures covering the restoration of the transmission system following total or partial blackouts. The users shall agree to these 'black start' procedures and inform promptly to the SLDC whenever they have difficulty.

9.4.3 The SLDC shall be responsible for directing the overall transmission system restoration process by co-ordination with all the users and in close co-ordination with the WRLDC.

9.4.4 The distribution licensees shall be responsible for sectionalising the distribution system into discrete, unconnected blocks of load. They shall advise the SLDC as to the quantum of load likely to be picked up by the plants being synchronized.

9.4.5 The generating plants shall be responsible for commencing their planned 'black start' procedure on the instruction of the SLDC and steadily increasing their generation according to the demand intimated by the SLDC.

9.5 Special consideration:-

9.5.1 During the process of restoration of the transmission system, or regional system blackout conditions, the normal standards of voltage and frequency need not be applied, and left to the discretion of the SLDC as it considers appropriate depending on the prevailing situation.

9.5.2 The distribution licensee shall separately identify non-essential components of essential loads, which may be kept off during system contingencies. They shall also draw up an appropriate schedule with corresponding load blocks in each case. The non-essential loads can be put on only when the system normalcy is restored, and as advised by the SLDC.

9.5.3 All users shall pay special attention in carrying out the procedures to prevent secondary collapse of the system due to haste or inappropriate loading.

9.5.4 Despite the urgency of the situation, careful, prompt and complete logging of all operations and operational messages shall be ensured by all the users to facilitate subsequent investigation into the incident and the efficiency of the restoration process. Such investigation shall be conducted promptly after the incident, an[illegible] SLDC shall placed before the Grid Code Review Panel for appraisal in its next in[illegible]ediate meeting.

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CHAPTER : 10

SAFETY AND LINE CLEAR PERMITS

10.1 SAFETY STANDARDS:

10.1.1 The "Safety Standard" issued separately formulates the precautions to be taken for ensuring safety for the general public, consumers of electricity and the workmen. This forms an integral part of this Code and STU/transmission licensee and all the users shall comply with this Standard.

10.1.2 STU/transmission licensee shall prepare his own "Safety manual" for the transmission lines; Substations based on this standard. For the guidance of the Shift Operators, "Operation and Maintenance Manuals" for each Sub-station shall be prepared by the licensee. These manuals shall contain all the maintenance and operation schedules based on the recommendations of the manufacturers of the various equipments installed in the Sub-station. These manuals shall be periodically reviewed based on the experience gained and replacement of equipments. A maintenance register for the equipments including the station batteries shall be maintained at the respective Sub-stations. These shall be updated as and when the maintenance work is carried out and shall be periodically reviewed by the appropriate higher authority in whose control the sub-station falls. Similar registers shall be maintained for the transmission lines.

10.1.3 The operation manual shall clearly contain the details of isolation and earthing to be provided for allowing work on the equipments. The single line Diagram of the Sub-station indicating the positions of various isolating devices shall be prominently displayed in the sub-station. Charts showing the clearances from live parts (section clearance) for working on the isolated equipments where workmen are allowed to work shall be displayed prominently at each sub-station.

10.1.4 The danger boards as required in the IE Rules, 1956 which are in force for time being and relevant Indian Standard shall be displayed at places approachable by the general public.

10.1.5 Regular maintenance shall be carried out on all the transmission lines in accordance with IS:5613 and records of all these shall be maintained. Wherever possible hot line checking and replacement of failed insulators shall be made before and after mansoon.

10.1.6 All the equipments in the receiving stations and sub-stations shall be maintained in good condition as per the manufacturer's manuals and relevant Indian and/or International standards, wherever available. The relays and circuit breakers shall be checked for their proper operation whenever these are taken out for maintenance purposes. The station batteries shall be maintained in good working condition by carrying out routine checks and maintenance works. The DC system provided in all these stations shall be properly maintained with no appreciable leakage current. An on-line monitoring system for monitoring of leakage and detection of ground faults shall be provided.

10.2 Line Clear Permit (LCP):

10.2.1 The format under Annexure "E" and "F" shall be used to request for permit to work on electrical line or equipment and to return the permit when the work on electrical line or equipment is over.

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CHAPTER : 11

OPERATIONAL EVENT AND INCIDENT/ACCIDENT REPORTING

11.1 Reportable Incidents:

11.1.1 All events in the transmission system having an operational effect on the user's system shall be notified by STU/transmission licensee to SLDC and the users, whose systems are affected.

11.1.2 All events on the user's system having an operational effect on the transmission system shall be notified by the user to STU/transmission licensee and SLDC who in turn shall notify the other users on whose system the event may have an operational effect. The user shall submit Annexure "D" for incident reporting.

11.1.3 Typical examples of reportable incidents that could affect the transmission system are as follows:

(a) Exceptionally high/low voltage or frequency,

(b) Serious equipment problem i.e. major circuit breaker, transformer, bus bar fault,

(c) Major problem in the generating unit,

(d) Tripping of ICT, transmission line or capacitor bank,

(e) Major fire incident, cyclones, storms earthquakes etc.,

(f) Major protection failure,

(g) Over loading of equipment or transmission line which may result in hazard to the personnel,

(h) Activation of any alarm or indication of abnormal operating condition,

(i) Adverse climatic conditions being experienced or forecast,

(j) Breakdown, or faults, or temporary changes in the capabilities of Plant and/or apparatus,

(k) Impending risks of protection operation,

(l) Loss of load,

(m) Accidents,

(n) Excessive drawal deviations,

(o) Minor equipment alarms.

The last two reportable incidents are typical examples of those of lesser consequences, but still affect the transmission system and can be reasonably classified as minor.They require corrective action but do not warrant management reporting immediately.

11.1.4 The examples indicated in the above are only illustrative and in no way limit the general requirements to be reported.

11.2 Reporting procedure:

11.2.1 All reportable incidents occurring in lines and equipments of 33kV and above at the grid sub-stations shall promptly be reported orally by the user whose equipment has experienced the incident to all other significantly affected users and SLDC. The reporting user should submit a written confirmation to SLDC within one hour of such oral report. If the reporting incident is of major nature, the written report may be submitted within two hours duly followed by a comprehensive report within 48 hours of the submission of the initial written report. In other cases, the reporting user shall submit a report within five working days to SLDC.

11.2.2 The SLDC shall call for a report from any user on any reportable incident affecting other users, in case such user, whose equipment might have been a source of the reportable incident, does not report the same. However, this shall not relieve any user from the obligation to report events in accordance with IE Rules, 1956 which are in force for time being and will be replaced by the rules made under Electricity Act, 2003. The format for such a report shall be as per the approval of the Grid Code Review Panel and typically contain the following:

(a) Location of the incident,

(b) Date and time of the incident,

(c) Plant or Equipment involved,

(d) Supplies interrupted and the duration wherever applicable,

(e) Amount of Generation lost, wherever applicable,

(f) System Parameters before and after the incident, (Voltage, Frequency, Flows, Generation etc.),

(g) Network configuration before the incident,

(h) Relay indications and performance of protection,

(i) Brief description of the incident,

(j) Estimated time of return to service,

(k) Any other relevant information,

(l) Recommendations for future improvement, and

(m) Name and designation of reporting officer.

11.2.3 The report shall contain sufficient details to describe the event to enable the recipient to assess the implications and risks arising out of the same. The cause need not be included in the report but the recipient may ask for clarifications wherever necessary and it is obligatory that the reporting user shall put his best efforts and provide all the necessary and reasonable information.

11.2.4 In case of a request by either party the oral report shall be written down by the sender and dictated by way of a telephone message or sent by fax/e-mail to the recipient. In case of an emergency the report can be given only orally and followed by written confirmation.

11.2.5 The maximum time limit allowed for oral report of the event is fifteen minutes from the time of the occurrence of the event.

11.2.6 SLDC will be responsible for reporting event in line with the procedure set in IEGC.

11.3 Significant events:

11.3.1 Significant event includes such events having an operational effect e.g.

(a) Tripping of plant and/or apparatus manually or automatically

(b) Voltage outside statutory limits

(c) System frequency outside statutory limits

(d) System instability or

(e) System overloads.

11.3.2 Wherever a user reports an event, which the SLDC or STU/transmission licensee considers to have had a significant effect on the transmission system, STU/transmission licensee may require the user to report that event in writing within one day.

11.3.3 Wherever STU/transmission licensee notifies SLDC and a user of any event which the user or SLDC considers to have had a significant effect on the users' system, the user may require the transmission licensee to report that event in writing within one day.

11.4 Warnings:

11.4.1 An oral warning shall be issued by SLDC and confirmed in writing as well, to the STU/ transmission licensee and the users, who may be affected when SLDC knows that there is a risk of widespread and serious disturbance to the whole, or part of, the total system.

11.4.2 Provided that sufficient time is available, the warning shall contain such information, as the SLDC considers reasonable, to explain the nature, extent of the anticipated disturbance, to the User and STU/transmission licensee, provided that such information is available to SLDC.

11.4.3 Each user and STU/transmission licensee, on receipt of such a warning, shall take necessary steps to warn its operational staff and maintain its Plant and apparatus in the condition in which it is best able to withstand the anticipated disturbance for the duration as confirmed / warned.

11.4.4 Scheduling and dispatch may be affected during the period covered by such a warning.

11.5 Loss of communication with the SLDC:

11.5.1 In the event of loss of communication with SLDC the provision made as above shall not apply but instead the following provision shall apply:

11.5.2 Each generating plants shall continue to operate in accordance with the last dispatch instruction issued by SLDC, but shall use all reasonable endeavors to maintain the system frequency at the target of 50Hz, plus or minus 0.5 Hz by monitoring frequency until such time the new dispatch instructions are received from SLDC.

11.6 Major failure:

11.6.1 Whenever a major failure takes place, STU/ transmission licensee and other users shall co-operate and inquire and establish the cause of such failure and produce appropriate recommendations. STU shall submit the enquiry report to the Grid Code Review Panel and submit the report to CSERC within one month of the incident.

11.7 Accident reporting:

11.7.1 If any accident occurs in connection with the generation, transmission, distribution, supply or use of electricity or in connection with any part of electric lines or electrical plant of any person and the accident results or is likely to have resulted in loss of human or animal life or any injury to a human being or an animal, the same shall be dealt with, in accordance with procedures laid down in the Power System Safety Standard.

11.7.2 Reporting of accidents shall be in accordance with the IE Rules, 1956, Rule 44-A. In both fatal and non-fatal accidents, the report shall be sent to the Electrical Inspector.

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CHAPTER : 12

DATA REGISTRATION

12.1 Responsibility:

12.1.1 All the users are responsible for submitting the up-to-date data in accordance with the provisions of the Grid Code. All the users shall provide STU, the names, addresses, and the telephone numbers of the persons responsible for sending the data. STU shall inform all the users the names, addresses and telephone numbers of the persons responsible for receiving the data.

12.1.2 STU shall provide up-to-date data to users as provided in the relevant Chapters of the Grid Code.

12.1.3 Responsibility for the correctness of these data rests with the concerned users providing the data.

12.1.4 The data schedules are structured to serve as standard formats for data submission and these formats shall be used for written data submission. Wherever standard data formats are not given, these should be developed by SLDC in consultation with the users.

12.1.5 All the data to be submitted to STU or to such other department including any other transmission licensee as STU may from time to time be notified to users. The name of the person who submits each schedule of data shall be indicated.

12.1.6 Wherever a computer data link exists between the user and SLDC/transmission licensee, data may be submitted through this link. The data shall be in the same format as specified for paper transmission except for electronic encoding for which some other format may be more appropriate. The user shall specify the method to be used in consultation with STU/SLDC/transmission licensee and resolve issues such as protocols, transmission speeds etc., at the time of transmission.

12.2 Changes in user's data:

12.2.1 Whenever the user becomes aware of the change to any items of the data registered under license, the user must promptly notify the STU of the changes. STU on receipt of the changes shall promptly correct the database accordingly. This shall also apply to any data compiled by STU regarding his own system.

12.3 Data not supplied:

12.3.1 All the users are obliged to supply the data referred to in the individual Sections of the Grid Code and listed above. In case any data is missing and not supplied by the user, STU may act reasonably. If and when necessary, he may estimate such data depending upon the urgency of the situation. Similarly in case any data is missing and not supplied by STU, the concerned user may, act reasonably. If and when necessary, he may estimate such data depending upon the urgency of the situation. Such estimates, in each case, shall be based upon the corresponding data for similar plant or apparatus, or upon such other information, the user or STU, as the case may be deems appropriate.

12.4 Special considerations:

12.4.1 STU or any user may at any time make reasonable request for extra data as necessary.

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CHAPTER : 13

MISCELLANEOUS

13.1 Other Codes and Regulations

User(s) shall ensure that new buildings, structures, additions, modifications and any other construction projects keep the minimum clearances required from existing supply lines of the licensee. These minimum clearances are specified in the Indian Electricity Rules, 1956 and the Safety Code as may be notified by the Commission.

13.2 Non-Compliance & Derogation

13.2.1 If any user is not in a position to comply, or fails to comply, with any of the provision(s) of the Grid code, it shall inform STU without delay of the reason for its non-compliance and shall take remedy for its non-compliance promptly.

13.2.2 Wrong declaration of capacity, non compliance of SLDC's load dispatch instructions, non-compliance of SLDC's instructions for backing down without adequate reasons, non-furnishing of data etc. shall constitute non-compliance of the Grid Code, which shall be subject to penalty as may be decided by the Commission.

13.2.3 Repeated failure to comply with the Grid Code may lead to disconnection of the user(s).

13.2.4 Derogation, if any, for any particular section or chapter of this Grid Code shall be with the permission of the Commission and for a specified time. Derogation of any requirement of the Grid Code shall be an exception and not the norm, and will be allowed only when it is not possible, and not just difficult or inconvenient, for the user to comply in the required time. Failure to comply with time period allowed for derogation by any user shall carry a penalty .

13.2 Service of Notice

Any letter, order or document addressed by the licensee to the user shall be deemed to be duly given, if served in writing and delivered by hand at, or sent by post/ courier, to the user address specified in the consumer's application or in the agreement with the user if entered into or as subsequently notified to the licensee. In case there is no person on the premises to whom the notice can with reasonable diligence be delivered, the notice may be served by affixing it on some conspicuous part of the premises.

All communications to the licensee shall be addressed to:

The Secretary of the licensee's company at the corporate office of the licensee or to any other officer authorised or designated in this behalf.

13.3 Unforeseen Circumstances

If any circumstances not envisaged in the provisions of the Grid Code, should arise, the licensee shall, to the extent reasonably practicable in the circumstances, consult promptly and in good faith, all affected parties in an effort to reach an agreement as to what should be done. If an agreement between the licensee and user cannot be reached in the time available, the licensee shall determine it in the manner best to its ability.

Wherever the licensee makes such a determination, it shall do so having regard, wherever possible, to the views expressed by the affected parties and, in any event, to what is reasonable in the circumstances. Each party shall comply with all instructions given to it by the licensee following such a determination, provided that the instructions are consistent with the prevailing Codes and Regulations. The licensee shall promptly refer all such unforeseen circumstances, and any such determination to the Commission.

13.4 Interpretation:

These conditions shall be read and construed as being subject, in all respects, to the provisions of the Electricity Act, 2003, the Indian Electricity Rules, 1956, Indian Electricity Grid Code, 2007 as amended from time to time and the Rules made therein and to the provisions of any other law relating to the transmission of electricity for the time being in force; and nothing contained in this Code shall abridge or prejudice the rights of the licensee and the consumer under any Central Act or State Act or Rules made there under.

In case of any dispute regarding the meaning or scope or interpretation of this Code, the interpretation of the Commission shall be final and binding on all concerned.

13.5 Power to remove difficulties:

If any difficulty arises in giving effect to any of the provisions of this, the matter may be referred to the Commission who after consulting the parties affected, where considered necessary, may pass any general or special order, not inconsistent with the provisions of the Act or any other enactment relating to supply of electricity for the time being in force, which appears necessary or expedient, for the purpose of removing the difficulty.

13.6 Jurisdiction of Court:

All proceedings arising out of this Code and the agreement made there under shall be filed only in the Court under whose jurisdiction the agreement was executed.

13.7 Savings

Nothing in this Code shall be deemed to limit or otherwise affect the inherent power of the Commission to make such orders as may be necessary to meet the ends of justice or to prevent abuses of the process of the Commission.

Nothing in this Code shall bar the Commission from adopting in conformity with the provisions of the Act, a procedure, which is at variance with any of the provisions of this Grid Code, if the Commission, in view of the special circumstances of a matter or class of matters and for reasons to be recorded in writing, deems it necessary or expedient for dealing with such a matter or class of matters.

Nothing in this Code shall, expressly or impliedly, bar the Commission dealing with any matter or exercising any power under the Act for which no provision has been made in the Grid Code, and the Commission may deal with such matters, powers and functions in a manner it thinks fit.

Note: In case of any difference in the interpretation or understanding of the provisions of the Hindi version of these Regulations with those of the English version (the original version), the latter will prevail and in case of any dispute in this regard, the decision of the Commission shall be final and binding.

By order of the Commission,
N.K. Rupwani, Secretary.

Annexure A

PLANNING DATA REQUIREMENTS (CLAUSE 3.3.2)

PART-I- GENERATION
(To be furnished by the Generating Company to STU)

A-1 Standard Planning Data (Generation)
A.1.1 THERMAL GENERAL

1. Site	Furnish location map (schematic) showing roads, Railway lines, transmission lines, rivers and reservoirs if any.
2. Approximate period of construction	
3. Annual Generation in Million KWH	

II CONNECTION

1. Connection point / interface point	Furnish single line diagram of the proposed connection with the transmission system with clear indication of possibility for right of way for unobstructed outlet
2. Step up voltage for connection kV	

III. STATION CAPACITY:

1. Total Generating Station Capacity (MW	
2. No. of Units and Unit size MW.	State whether development will be carried out in phases and if so, furnish details

IV. GENERATING UNIT DATA:

1. Steam Generating Unit	
Type,capacity, steam pressure,steam temperature etc-	
2.Steam turbine	
Type ,Capacity	
3.Generator	
(a) Make and Type	
(b) Rating (MVA)	
© Terminal Voltage (kV)	
(d) Rated Power Factor	
(e) Reactive Power capability (MVAr) in the range 0.95 leading and 0.85 lagging.	
(f) Short Circuit Ratio	
(g) Direct axis transient reactance (% on MVA rating)	
(h) Direct axis sub-transient reactance (% on MVA rating)	
(i) Auxiliary Power requirement	
(j) MW and MVAr Capability curve	
2. Generator Transformer	
(a) Type	
(b) Rated Capacity (MVA)	
(c) Voltage Ratio (HV/LV)	
(d) Tap change range (+% to -%)	
(e) Percentage Impedance (Positive Sequence at Full load).	

A.1.2 DETAILED PLANNING DATA (GENERATION)
THERMAL GENERATING STATIONS:

I GENERAL:

a. Name of Generating Station:
b. No. of capacity of Generating Units (MW):
c. Single line diagram of Generating Station and switchyard
d. Relaying and metering diagram
e. Neutral Grounding of Generating Units
f. Excitation control
g. Earthing arrangements with earth resistance values
h. Communication – Details of PLCC and other communication equipment installed.

II PROTECTION AND METERING:

1. Full description including settings for all relays and protection systems installed on the Generating Unit, Generating Unit Transformers, Auxiliary Transformer and electrical motor of major equipment viz. boiler feed pump, ID fans, condensate extraction pump etc.
2. Full description including settings for all relays installed on all outgoing feeders from Generating Station switchyard, tie circuit breakers, incoming circuit breakers.
3. Full description of inter-tripping of circuit breakers at connection (point(s) / Interface points (s) with the transmission system.
4. Most probable fault clearance time for electrical faults on the user's system.
5. Full description of operational and commercial metering schemes.
6. Breaker operating time counting from initiation of protective relay to the opening of breaker.

III SWITCHYARD:

1. In relation to Interconnecting Transformers between EHV/HV transmission system and the Generator Transformer Voltage System:
   (a) Rated MVA
   (b) Voltage Ratio
   (c) Vector Group
   (d) Positive sequence reactance (Maximum, minimum, normal tap (% on MVA)
   (e) Positive sequence resistance (Maximum, minimum, normal tap (% on MVA)
   (f) Zero sequence reactance (% on MVA)
   (g) Tap changer range (+% to -%) and steps
   (h) Type of tap changer (OFF/ON)
   (i) Details of reactors, and other circuits connected to tertiary winding of ICT:
   (j) Method of grounding.
2. In relation to switchgear including circuit breakers, isolators on all circuits connected to the points of connection:
   (a) Rated Voltage (kV)
   (b) Type of Breaker (MOCB/ABCD/SF_6---)
   (c) Rated short circuit breaking current (kA) 3 phase
   (d) Rated short circuit breaking current (kA) 1 phase
   (e) Rated short circuit making current (kA) 3 phase
   (f) Rated short circuit making current (kA) 1phase
   (g) Provisions of auto reclosing with details
   (h) Details of instrument transformers.
3. Lightning arresters, technical data.
4. Communication – Details of PLCC and other communication equipment installed at connection point(s) / interface point(s).
5. Basic insulation level (kv):
   (a) Bus bar
   (b) Switchgear
   (c) Transformer bushings
   (d) Transformer windings

IV GENERATING UNITS:

A. PARAMETERS OF GENERATING UNITS:

1. Rated terminal voltage (kV)
2. Rated MVA
3. Rated MW
4. Inertia constant H(MW Sec./MVA) of Generator
5. Short circuit ratio
6. Direct axis synchronous reactance(% on MVA) (Both unsaturated and saturated)
7. Direct axis transient reactance(% on MVA) (Both unsaturated and saturated)
8. Direct axis sub-transient reactance(% on MVA) (Both unsaturated and saturated)
9. Quadrature axis synchronous reactance(% on MVA) (Both unsaturated and saturated)
10. Quadrature axis transient reactance(% on MVA) (Both unsaturated and saturated)
11. Quadrature axis sub-transient reactance(% on MVA) (Both unsaturated and saturated)
12. Direct axis transient open circuit time constant (Sec) $T'd_0$
13. Direct axis sub-transient open circuit time constant (Sec) $T'd_0$
14. Quadrature axis transient open circuit time constant (Sec) $T'd_0$
15. Quadrature axis sub-transient open circuit time constant (Sec) $T'd_0$
16. Stator resistance (Ohm)
17. Stator leakage reactance (Ohm) T_a
18. Stator time constant (Sec)
19. Rated field current (A)
20. Open circuit saturation characteristic for various terminal voltages giving the exciting current to achieve the same.
21. Generator Capability Curve
22. Rated stator current (A)
23. Phase connection
24. Number of terminals brought out
25. Rated speed(rpm)
26. Rated frequency (Hz.)
27. Efficiency at MCR condition (percent)
28. Negative sequence current capability (I^2T)
29. Capacitance of generator stator winding to ground (microF/ph)
30. DC Resistance of rotor at 20^0 C (in ohm)
31. Zero sequence reactance X_0 (Percentage)
32. Negative sequence reactance X_2 (Percentage)
33. Negative sequence reactance R_2 (Percentage)
34. Sub-Transient S-C time constant (in second)
    a. Direct axis T"d
    b. Quadrature axis T"q
35. Transient S-C time constant (in second)
    a. Direct axis T"d
    b. Quadrature axis T"q
36. Machine saturation at 1.0 pu voltage in p.u.
37. Machine saturation at 1.2 pu voltage in pu
38. Percentage regulation
39. Short circuit characteristics curves.

B. PARAMETERS OF EXCITATION CONTROL SYSTEM:

1. Type of Excitation
2. Maximum Field voltage
3. Minimum Field voltage
4. Rated Field voltage
5. Gain factor
6. Feed back strength
7. Time constant for control amplifier

8. Time constant for Exciter
9. Time constant for Feed Back
10. Output voltage of control amplifier
11. Maximum output voltage of control amplifier
12. Minimum output voltage of control amp r
13. Details of excitation loop in block d . ams showing transfer functions of individual elements using IEEE symbols along with set values
14. Dynamic characteristics of over – excitation Limiter
15. Dynamic characteristics of under – excitation Limiter
16. Exciter IEEE model / Type No.
17. Exciter response time.

C. PARAMETERS OF GOVERNOR / TURBINE:

1. Governor average gain (MW/Hz)
2. Speeder motor setting range
3. Time constant of steam or fuel.Governor valve
4. Governor valve opening limits
5. Governor valve rate limits
6. Governor valve rate limits
7. Time constant of Turbine (HP, IP, LP)
8. Governor block diagram showing transfer functions of individual elements using IEEE symbols alongwith set valves
9. Type of governor, whether IEEE standard governor used
10. Regulation and droop
11. Fraction of total power generated HP, IP, LP turbine.
12. Maximum velocity limit HP, IP, LP turbine
13. Minimum velocity limit HP,IP, LP turbine.

D. OPERATIONAL PARAMETERS:

1. Min. notice required for synchronizing a Generating Unit for De-synchronization.
2. Min. time between synchronizing different Generating Units in a Generating Station.
3. The minimum block load requirements on synchronizing
4. Time required for synchronizing a Generating Unit for the following conditions:
   (a) Hot
   (b) Warm
   (c) Cold
5. Maximum Generating Unit loading rate for the following conditions:
   (a) Hot
   (b) Warm
   (c) Cold
6. Minimum load without oil support (MW)

V. PLANT PERFORMANCE:

1. Daily Demand Profile (Last Year)	Half hourly integrated demand through out the day
2. Units Generated (Million KWH)	
3. Units consumed in Auxiliaries (Million KWH)	
4. Units supplied from system to Auxiliary Load	
5. Seasonal Generation	

A.1.3 HYDRO ELECTRIC GENERAL:

1. Site	Furnish location map (schematic) showing roads, Railway lines, transmission lines, rivers and reservoirs if any.
Whether storage type, run of river type	
Full reservoir level	
Tail race level	
Design head	
Minimum draw down level	
Reservoir level v/s energy poetential curve	
2. Approximate period of construction	
3. Annual Generation in Million KWH	

II. CONNECTION:

(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

III. STATION CAPACITY:

(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

IV. GENERATION UNIT DATA:

1. Operating Head	
a)Maximum	
b)Minimum	
c)Average	
Hydro Unit	
a) Capability to operate as synchronous condenser	
b) Water head versus discharge curve(at full and part load)	
c) Power requirement or water discharge while operating as synchronous condensor	
2.Turbine	
Type ,Capacity	
3.Generator	
(a) Make and Type	
(b) Rating (MVA)	
© Terminal Voltage (kV)	
(d) Rated Power Factor	
(e) Reactive Power capability (MVAr) in the range 0.95 leading and 0.85 lagging.	
(f) Short Circuit Ratio	
(g) Direct axis transient reactance (% on MVA rating)	
(h) Direct axis sub-transient reactance (% on MVA rating)	
(i) Auxiliary Power requirement	
2. Generator Transformer	
(a) Type	
(b) Rated Capacity (MVA)	
(c) Voltage Ratio (HV/LV)	
(d) Tap change range (+% to -%)	
(e) Percentage Impedance (Positive Sequence at Full load).	

A.1.4 HYDROELECTRIC STATIONS:

I. GENERAL:

1. Name of Generating Station
2. No. and capacity of units (MW)
3. Expected level of generation (MU)
4. Period of generation (in months) oer year
5. Whether the plant is based on water released from dam/canal for irrigation purposes
6. Rating of al major equipments.
7. Single line diagram of Generating Station and switchyard
8. Relaying and metering diagram
9. Neutral grounding of generator
10. Excitation control
11. Earthing arrangements with earth resistance values
12. Communication - Details of PLCC and other communication equipment installed.

II. PROTECTION:
(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

III. SWITCH YARD:
(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

IV. GENERATION UNITS:

A. PARAMETERS OF GENERATING UNITS:
(AS APPLICABLE TO THERMAL GENERATING STATION MENTIONED ABOVE)

B. PARAMETERS OF EXCITATION CONTROL SYSTEM:
(AS APPLICABLE TO THERMAL GENERATING STATION MENTIONED ABOVE)

C. PARAMETERS OF GOVERNOR / TURBINE:
(AS APPLICABLE TO THERMAL GENERATING STATION MENTIONED ABOVE)

D. OPERATIONAL PARAMETERS:

1. Minimum notice required for synchronizing a Generating Unit for De-synchronization.
2. Minimum time between synchronizing different Generating Units in a Generating Station
3. Minimum block load requirements of Synchronizing.

A1.5 FOR THERMAL GENERATING STATIONS, if desired by STU:

A. CONNECTION:

1. Report of studies of parallel operation with transmission system:
   (a) Load flow studies
   (b) Stability studies
   (c) Short Circuit studies
2. Proposed connection with transmission system
   (a) Voltage
   (b) No. of circuits
   (c) Connection point (s) / interface point (s)

II. HYDROELECTRIC GENERATING STATIONS:
(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

PART II – DISTRIBUTION
(To be furnished by the Distribution Company to STU)

B-1 Standard Planning Data Distribution
I. GENERAL:

1. Single Line Diagram : Licensee-wise upto 33kV Substations
2. Consumer Data Furnish category wise number of consumers, their connected Loads to the best judgment of the distribution licensee.
3. Reference to are officers presently incharge of the distribution.

II. CONNECTION:

1. Connection points/interface points: Furnish single line diagram showing connection points / interface points.
2. Voltage of supply at connection points/interface points:
3. Names of grid Sub-station feeding the connection pints / interface points:

III. LINES AND SUB-STATIONS:

1. Line Data: Furnish length of line and voltages (EHV level)
2. Sub-station Data: Furnish transformer details of 220/132kV, 132/33kV, 33/11kV, Sub-stations, capacitor installations.

IV LOADS

1. Loads drawn at connection points/ interface points:	If the distribution licensee receive power at a number of connection points in a compact area, which are interconnected in a ring, then such distribution licensee shall forward the overall load drawn for overall Area of Supply as well as at each connection point with the variation or tolerance as mutually discussed and agreed upon with the STU
2. Details of loads fed at EHV, if any	Give name of consumer, voltage of supply, contract demand and name of grid Sub-station from which the line is drawn, length of EHT line from grid Sub-station to consumer's Premises.

V. DEMAND DATA (FOR ALL LOADS 5 MW AND ABOVE):

1. Type of Load & Rating in HP or KW	State whether furnace loads, rolling mills, traction loads, other industrial loads, pumping loads etc.
2. Rated voltage:	
3. Electrical loading of equipment	State number and size of motors, rating or arc furnaces/induction furnace, types of drive and control arrangements.
4. Sensitivity of load to voltage and Frequency of supply:	
5. Maximum harmonic content of Load:	
6. Average and maximum phase unbalance of Load:	

7. Nearest Substation from which load is to be fed:	
8. Location map to scale:	Map shall show the location of load with reference to lines and sub-stations in the vicinity.

VI LOAD FORECAST DATA:

1. Peak load for connection point / interface point as well as peak load and energy forecast of Area of Supply for each of the succeeding 10 years.
2. Details of methodology and assumptions on which forecasts are based
3. Details of load 5MW and above:
   a. Name of prospective consumer
   b. Phasing of load.

***

B-2 DETAILED PLANNING DATA (Distribution)

I. GENERAL:

1. Schematic Single Line Diagram of Distribution System (showing distribution lines from connection point / interface points with transmission system 220kV/ 132kV, 132/33kV, & 33/11 kV Substations, consumer bus if fed directly from transmission system).
2. Numbering and nomenclature of lines and substations (Identified with feeding grid Substations of the transmission system and concerned 220kV/132kV, 132/33kV, and 33/11kV substation).

II CONNECTION:

1. Connection point / interface points (Furnish details of existing arrangement of connection).
2. Details of metering of connection points / interface points.

B.2 DETAILED PLANNING DATA (Distribution)

(For submission on request by STU)

I CONNECTION:

1. Connection pints/ interface points as applied for:
   (a) New
   (b) Upgrading existing connection
2. Changes in metering at connection pints / interface points.

II. LOADS:

1. Details of major loads of 1 MW and above to the contracted for next ten years.

***

Annexure – B.

DETAILED TRANSMISSION SYSTEM DATA (CLAUSE 3.3.3)
(To be furnished to the User on request by STU/ Transmission Licensee)

B-1 Standard Planning Data (Transmission)

1. Name of the line: (Indicating Generating Stations and Substations to be connected)
2. Voltage of line (kV):
3. No. of circuits:
4. Route length (CKM):
5. Conductor sizes:
6. Line parameters (PU on 100 MVA base or ohmic values) — Resistance/KM, Inductive Reactance/KM, Suceptance/KM
7. Approximate power flow MW & MVAr:
8. Line Route (Topographic Sheets)
9. Purpose of connection: — Reference to scheme, wheeling to other States etc.
10. Approximate period of construction:

B-2 DETAILED SYSTEM DATA (Transmission):

I. GENERAL:

1) Single line diagram of the transmission system upto 33kV bus at grid sub-station.
2) Name of substation
3) Generation Station connected
4) Number and length of circuits
5) Interconnecting Transformers
6) Substation bus layouts
7) Power transformers
8) Reactive compensation equipment
   (a) The details of capacitors installed
   (b) Additional capacitors to be commissioned along with additional loads.
9) Lightning arresters
10) Bus and / or line reactors

II SUB-STATION LAYOUT DIAGRAMS SHOWING:

1. Bus bar layouts
2. Electrical circuitry, lines, cables, transformers, switchgear etc.
3. Phasing arrangements
4. Earthing arrangements
5. Switching facilities and interlocking arrangements
6. Operating voltages
7. Numbering and nomenclature
   (a) Transformers
   (b) Circuits
   (c) Circuit breakers
   (d) Isolating switches

III LINE PARAMETERS: (FOR ALL CIRCUITS)

1. Designation of line
2. Length of lien (KM)
3. No. of circuits, size and type of conductor, thermal rating

4. Per circuit values
   a. Operating voltage (kV)
   b. Positive phase sequence reactance – ohms/KM
   c. Positive phase sequence resistance – ohms/KM
   d. Positive phase sequence suceptance – ohms/KM
   e. Zero phase sequence reactance – ohms/KM
   f. Zero phase sequence resistance – ohms/KM
   g. Zero phase sequence suceptance – ohms/KM

IV. TRANSFORMER PARAMETERS:
(FOR ALL TRANSFORMERS SUB-STATION-WISE)

1. Rated MVA
2. Voltage ratio
3. Vector group
4. Positive sequence reactance on rated MVA base (Max. Min & normal)
5. Positive sequence resistance on rated MVA base(max. min. & normal)
6. Zero sequence reactance on rated MVA base
7. Tap change range (+% to -%) and steps
8. Details of tap changer (OFF/ON)
9. Neutral grounding transformer/resistor values
10. % Impedance (Max./Min/Normal Tap)

V. EQUIPMENT DETAILS: (FOR ALL SUB-STATIONS):

1. Circuit breakers
2. Isolating switches
3. Current transformers
4. potential transformers
5. Lightning arresters
6. Earthing switches

VI. RELAYING AND METERING:

1. Relay protection installed for all transformers and feeders along with their settings and level, of coordination with other uses.
2. Metering Details.

VII SYSTEM STUDIES:

1. Load flow studies (Peak and lean load for maximum Hydro and maximum Thermal Generation).
2. Transient stability studies for 3 Phase fault in critical lines, and single pole reclosing for 400 kV lines and critical 220kV lines.
3. Dynamic stability studies
4. Short circuit studies (3 phase and single phase to earth)
5. Transmission and distribution losses in the system.

VIII: DEMAND DATA: (FOR ALL SUB-STATIONS)

1. Demand Profile (Peak and off Peak load)
   (b) Forecast for next 5 years.

IX REACTIVE COMPENSATION EQUIPMENT:

1. Type of equipment (fixed or variable)
2. Capacities and/or inductive rating (Voltage and MVAr) or its operating range.
3. Details of control
4. Connection point/ interface point to the system.

B.3 DETAILED PLANNING DATA (Transmission):

I. CONNECTION:-

1. Single Line Diagram showing position of connection.

2. Sub-station layout diagram
   (a) New
   (b) Addition and alteration

3. Revised system studies with changed parameters

4. Connection point / interface point:
   a. Voltage
   b. Length of circuit
   c. Circuit parameters
   d. PLCC facilities
   e. Relaying with inter tripping arrangements to inter trip system breaker at connection point / interface point to isolate on fault
   f. Metering at connection point / interface point
   g. Other communication facility

***

Annexure – C

SITE RESPONSIBILITY SCHEDULE (CLAUSE 4.7.2)

Name of the Connecting Station / Substation
Telephone No.
Fax No.
Permanent Address

Item of Plant or Apparatus .... KV Switch Yard*	**Plant Owner**	**Responsibility for**				**Remarks**
Feeders						
Generating Units						

* Shall include details of the following:

i. Bus bars
j. Circuit breakers
k. Isolator
l. Bypass facilities
m. Earthing switches
n. Overhead line entry / gantry
o. Overhead line tapping
p. Cable and cable sealing ends
q. Generating Unit
r. Generating Unit Auxiliary Transformers including Low Voltage Circuit Breakers
s. Station Service Transformers including Low Voltage Circuit Breakers
t. Capacitors including Synchronous Condensers
u. Series or shut reactors
v. Tertiary windings
w. Earthing and Auxiliary Transformers
x. Three phase voltage transformers
y. Single phase voltage transformers and phase identity
z. Surge arresters
aa. Neutral earthing arrangement on HV Plant
bb. Current transformers
cc. Potential transformer
dd. Equipment related to PLCC and SCADA.

Annexure - D

INCIDENT REPORTING (CLAUSE 11.1.2)

FIRST REPORT

Date......
Time ....

1. Date and time of incident
2. Location of incident
3. Type of incident
4. System parameters before the incident (Voltage, Frequency, Generation, etc.)
5. System parameters after the incident
6. Network configuration before the incident
7. Relay indications received and performance of protection
8. Damage to equipment
9. Supplies interrupted and duration, if applicable.
10. Amount of Generation lost, if applicable.
11. Estimate of time to return service.
12. Cause of incident
13. Any other relevant information and remedial action taken.
14. Recommendations for future improvement/ repeat incident
15. Name of Organization.

Annexure - E

ORIGINAL

(Safety) Form

PERMIT TO WORK ON ELECTRICAL EQUIPMENT OR LINE (Clause 10.2.1)

Issued to ....

I hereby declare that following electrical equipment / line is dead and isolated from all line conductors:-

Caution notices have been affixed to all the controlling switches,

Here state exactly the electrical equipment / line, on which it is safe to work.

Here state exactly the points the electrical equipment / line is connected to earth.

<u>All Other Equipment / Line are Live</u>

Here state any specific limits or instructions which issuer may like to add :- (........................

Signature with date, time and designation (when Permit is by phone. The name of the Authorized person at apposite end must be noted.) ((.......... issuer (Sending end.)

Serial number of permit (when permit is by phone) (........................ (Receiving end.)

Note : 1) This card after being signed by a competent person for the work to proceed, is to be handed to the authorized person in charge of the work and retained by that person until the work is completed or stopped by the authorized person.

2) The electrical equipment mentioned hereon must not be again made alive until this card has been signed and returned by the person in charge of the work to the issuer of permit.

I hereby declare that all man, earthing and materials under my charge have cleared the site equipment / line and men have been warned that it is no longer safe to work on the electrical equipment specified on the card.

Signature ....
Designation ....

Date :
Time :

I hereby declare this card canceled.

Signature ....

Designation ....

Date :
Time :

Annexure - F

DUPLICATE

(Safety) Form

PERMIT TO WORK ON ELECTRICAL EQUIPMENT OR LINE (Clause 10.2.1)

Issued to ....

I hereby declare that following electrical equipment / line is dead and isolated from all line conductors:-

Caution notices have been affixed to all the controlling switches,

Here state exactly the electrical equipment / line, on which it is safe to work.

Here state exactly the points the electrical equipment / line is connected to earth.

All Other Equipment / Line are Live

Here state any specific limits or instructions which issuer may like to add :- (.....................

Signature with date, time and designation (when Permit is by phone. The name of the Authorized person at apposite end must be noted.) (

(.......... issuer
(Sending end.)

Serial number of permit (when permit is by phone) (.......................
(Receiving end.)

(to be used when permit is applied over telephone)

APPLICATION

From To

.... At
....

Please issue me permit to work on ......
....
....

Signature ....

Designation ....

संचालक, मुद्रण तथा लेखन सामग्री, छत्तीसगढ़ द्वारा शासकीय क्षेत्रीय मुद्रणालय, राजनांदगांव से मुद्रित तथा प्रकाशित—2007.